Improving CDRL Production - A Northrop Grumman Mission Systems Six Sigma Initiative

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Mission Systems Overview

- **Tactical**
  - Battlefield Digitization
  - Tactical Operations Centers
  - Army Logistics

- **Strategic**
  - Missile Systems
  - Command and Control

- **Missile Defense**
  - Battle Management C3
  - Joint National Test Facility
  - Systems engineering

- **Space Operations**
  - Satellite Command & Control
  - Space Network Sustainment

- **Professional services**
  - Defense Travel System

- **Customers**
  - U.S. Army
  - U.S. Air Force
  - Ballistic Missile Defense Organization
  - Joint Forces Command
  - U.K. Ministry of Defense
Mission Systems Six Sigma Initiative

A disciplined, data-driven methodology improving program and business performance

- Focuses on process performance by eliminating defects and reducing variation
- Establishes a common language and set of tools
- Identifies what’s critical to quality in the eyes of the customer
- Uses metrics to measure process capability
- Process improvement linked to organizational strategic objectives
  - Decomposes larger, strategic goals / gaps into a series of projects
  - Prioritized based upon expected financial benefit

Six Sigma is about satisfying our customers
CDRL Production
Defect Cause and Effect

LATE DELIVERY
- INSUFFICIENT TIME ALLOWANCE
- DUE DATE UNCERTAINTY
- LACK OF FUNDING
- LOW PRIORITY
- LATE GFI/CFE

INCOMPLETE DATA
- LACK OF TIME
- CUSTOMER/SUPPLIER MISUNDERSTANDING
- MISSING SECTIONS
- LACK OF FUNDING
- LOW PRIORITY
- LATE GFI/CFE

INACCURATE DATA
- LACK OF PARTICIPATION
- OUT-OF-DATE INFORMATION
- CURSORY REVIEW
- LACK OF TIME
- LACK OF RESPONSIBILITY
- LACK OF KNOWLEDGE
- LOW PRIORITY
- LATE GFI/CFE

Defective artifacts produced inefficiently

Number of survey complaints
### CDRL Production Survey Results

#### Stakeholders

<table>
<thead>
<tr>
<th>CDRL Production Process Steps</th>
<th>Program Manager</th>
<th>Responsible Engineer</th>
<th>Project Reviewers</th>
<th>Customer Reviewers</th>
<th>Project Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assign CDRLs</strong></td>
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<td><strong>Negotiate and Plan</strong></td>
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<tr>
<td><strong>Research Policies &amp; DIDs</strong></td>
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<tr>
<td><strong>Coordinate Outline</strong></td>
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<tr>
<td><strong>Interpret DIDs</strong></td>
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<td></td>
<td>0.28%</td>
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<tr>
<td><strong>Translate Design Products</strong></td>
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<td>0.35%</td>
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<tr>
<td><strong>Prepare CDRLs</strong></td>
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<td><strong>Perform Internal Review</strong></td>
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<td><strong>Update CDRLs</strong></td>
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<tr>
<td><strong>Publish Draft CDRLs</strong></td>
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<td>0.60%</td>
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<td><strong>Analyze Customer Comments</strong></td>
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<tr>
<td><strong>Update CDRLs</strong></td>
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<tr>
<td>*<em>Publish CDRLs</em></td>
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* Value added step
<table>
<thead>
<tr>
<th>Process improvement</th>
<th>Benefits and project effort reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outline definition</td>
<td>0.28% → 0.09% (as-is → to-be)</td>
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<tr>
<td>‒ Predefined templates</td>
<td>‒ Improved definition efficiency, improved artifact</td>
</tr>
<tr>
<td>‒ Consistent Data Item Descriptions</td>
<td>‒ quality and consistency</td>
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<tr>
<td>‒ Guidelines for template use</td>
<td>‒ Tailoring for unique contract features</td>
</tr>
<tr>
<td>‒ Compliance with policies/processes</td>
<td>‒ Improved definition efficiency</td>
</tr>
<tr>
<td>Artifact translation</td>
<td>0.35% → 0.18% (as-is → to-be)</td>
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<tr>
<td>‒ Alternative data format guidelines</td>
<td>‒ Reduced translation effort</td>
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<tr>
<td>‒ Electronic referencing</td>
<td>‒ Improved generation / review efficiency</td>
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<tr>
<td>Review and update</td>
<td>0.60% → 0.30% (as-is → to-be)</td>
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<tr>
<td>‒ Customer pre-coordination</td>
<td>‒ Reduced rework, increased satisfaction</td>
</tr>
<tr>
<td>‒ Electronic document cross reference</td>
<td>‒ Improved preparation/review efficiency</td>
</tr>
<tr>
<td>‒ Reviewer checklists</td>
<td>‒ Improved review quality &amp; efficiency</td>
</tr>
<tr>
<td>‒ Electronic editing and commenting</td>
<td>‒ Improved review and update efficiency</td>
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<tr>
<td>Total</td>
<td>1.23% → 0.57% (as-is → to-be)</td>
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</table>
Design and implementation artifacts
- Software System Design Description (SSDD)
- Interface Design Description (IDD)
- Software Description Document (SDD)
- Database Description Document (DBDD)
- Software Product Specification (SPS)
- Software User Manual (SUM)

• System Development Life Cycle
• IEEE 12207 development process
• Military Standard 498 DIDs

C4ISR Operational, System & Technical Views
Institutionalizing Improvements

- Communications
- Sharing best-practices
- Measurement & dashboards

Industry/Government Standards
- CMMI
- ISO
- Customer Specific

Process Improvement
- Organizational Policies & Processes
- Organizational Training & Tools
- Metrics Database
- Project Results
- Project Performance
- Project Plans
- Project Schedules & Budgets