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Process Approach to Determining Quality Inspection Deployment Product Overview

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Eric S. Richter and Arthur L. McClellan
Systems and Operations Assurance Department
Mission Assurance Subdivision

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National Reconnaissance Office
14675 Lee Road
Chantilly, VA 20151-1715

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Eli Minson – Ball Aerospace and Technologies Corporation
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Eric Richter – The Aerospace Corporation

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Kathy Augason – Lockheed Martin Corporation
Kevin Craig – SSL
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Neil Limpanukorn – SSL
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Michael Phelan – DCMA
Robert Pollard – Ball Aerospace and Technologies Corporation
Thomas Reinsel – Raytheon

Process Approach to Determining Quality Inspection Deployment

Product Overview

Eli Minson, Ball Aerospace
Frank Pastizzo, SSL
Eric Richter, The Aerospace Corporation

May 7, 2015

Agenda

- Motivation and Team Charter
- Product Overview
- Examples
- Topic Details
- Topic Follow-on Recommendations
- Team Membership and Recognition

Motivation for Topic

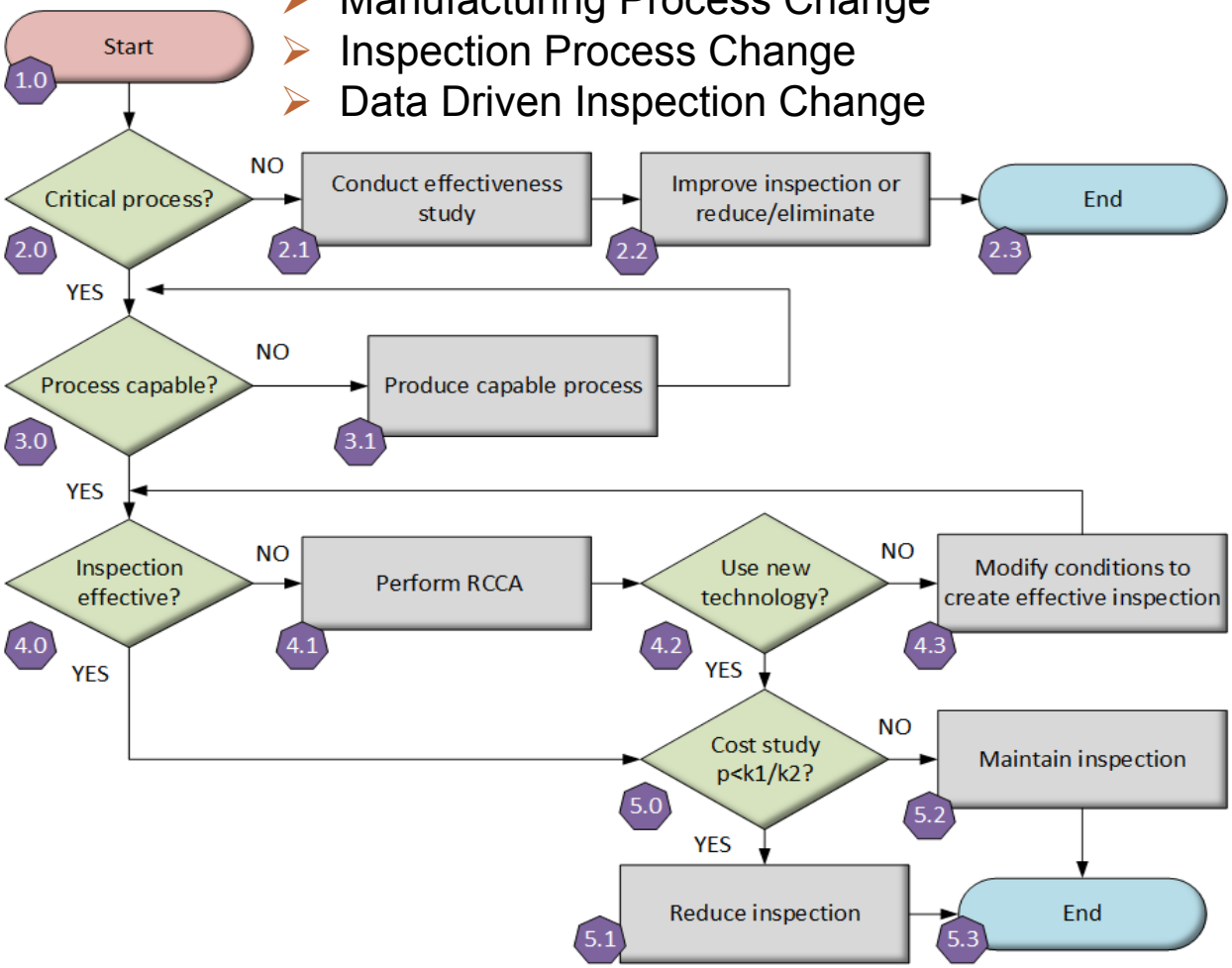
- DOD issued 55 years ago MIL-Q-9858A and MIL-I-45208A
  - *Emphasis on complete and frequent visual inspection*
- Technology has improved since then
  - *Process controls*
  - *Product quality*
  - *Inspection capabilities*
- Inspection change versus risk guidance is lacking

Team Charter

- Develop a tool for determining if a change in inspection approach is warranted
  - *Review industry data and feedback from DCMA to identify candidate processes*
  - *Identify best practices for optimal quality inspection planning and deployment*
  - *Evaluate candidate processes using new tool*

Decision Tree

- Manufacturing Process Change
- Inspection Process Change
- Data Driven Inspection Change

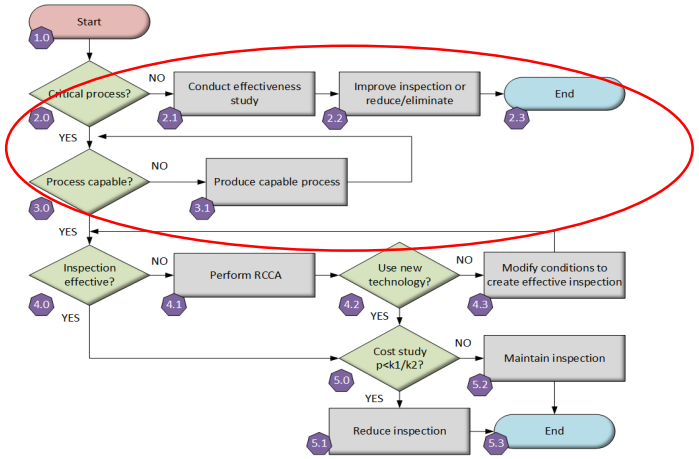


Example

ICT via Flying Probe

- Shift inspection of PWB from manual inspection to flying head automated probe
  - *False errors manual inspection reduced*
  - *Time study of the same board shows significant time reduction*
  - *Output of machine lists part non-conformities*
  - *Manual Inspection covers10-20% of parts not covered by the machine*

In-Circuit Test via Flying Head Probe Analyses Performed



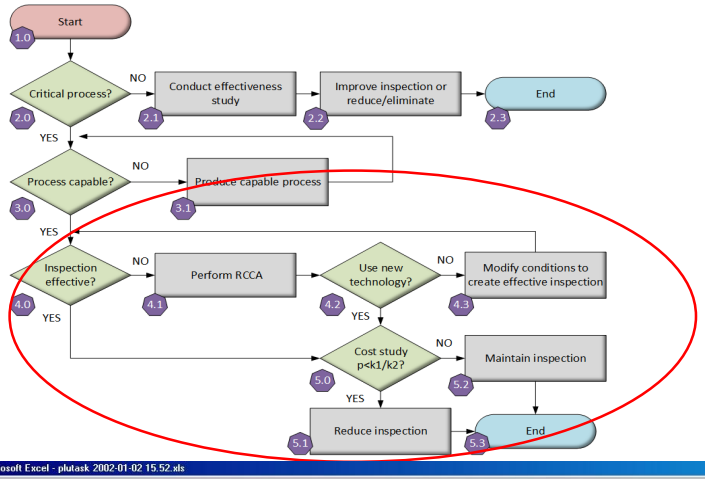
Critical Process

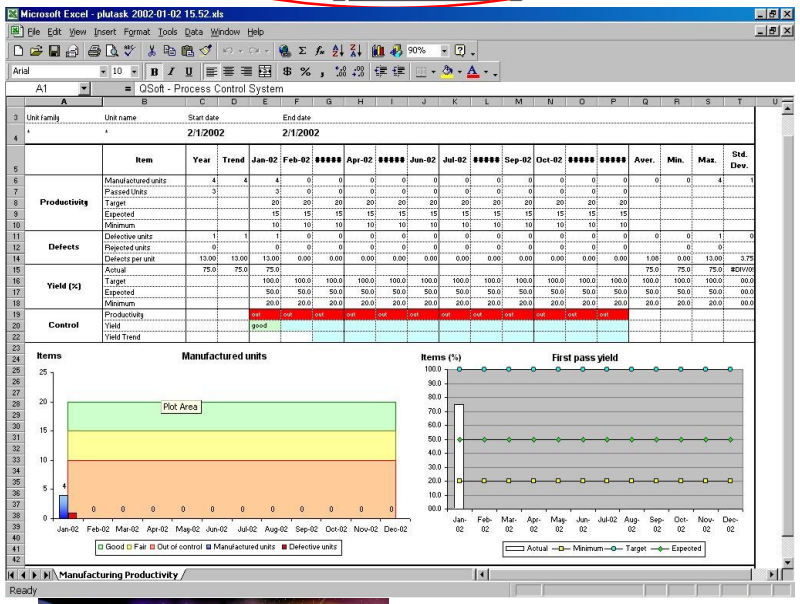
- Reviewed historical inspection process output
- Reviewed customer requirements
- Identified potential tool suppliers
- Performed risk analysis against existing processes
- Study of cost vs. CAPEX vs. inspection performance completed

Process Capability

- Reviewed supplier tool sets
- Performed bench test using EDU boards
- Verified results against existing inspection method
- Identified process accuracy and repeatability issues
- Compared results to risk and cost analyses

In-Circuit Test via Flying Head Probe Analyses Performed





Effective Inspection

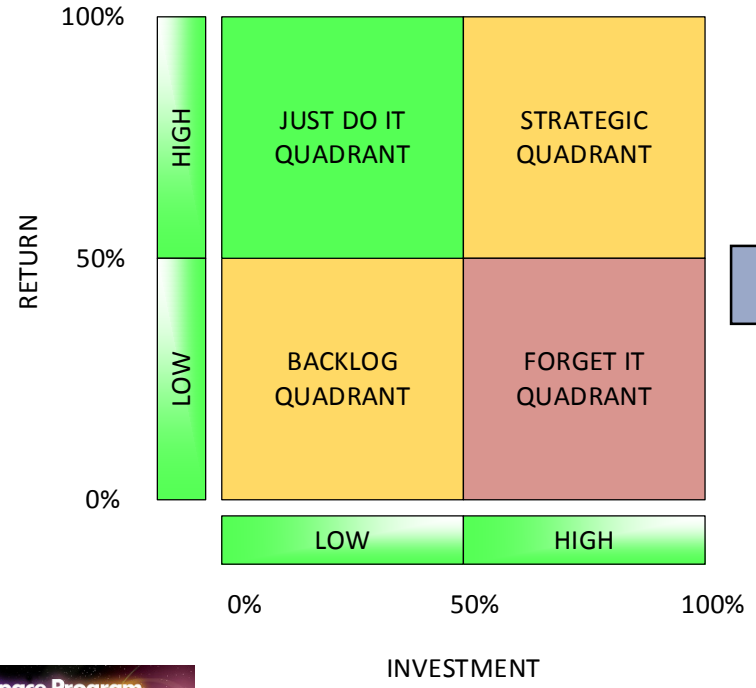
- Test board coverage and issues reviewed
- Identified requirements against typical part usage
- Identified part types and applications where ICT not able to capture all issues

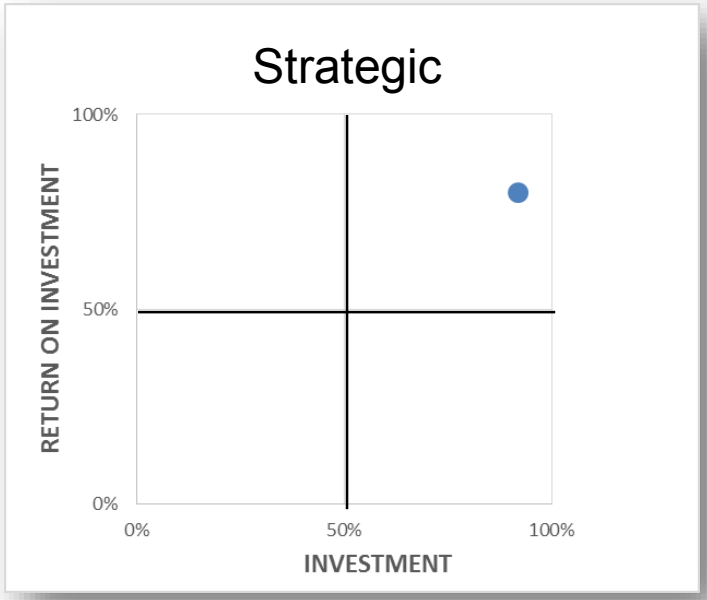
ROI

- Performed study for purchasing unit vs. outsourcing
- Identified multiple suppliers and reviewed capabilities against requirements

Analysis Results into Tool

Analysis Category	Entries in tool	Manufacturing Process Change	Inspection Process Change	Data Driven Insp. Change
Manufacturing	Lines 1-5	40%	22%	22%
Inspection	Lines 6-8	30%	45%	38%
Cost and Customer	Lines 9-10	30%	33%	40%





Tool Design

Analyses

1. Do the results of a PFMEA show potential for improved quality?
2. Is the process qualified and capable?
3. Does the first article indicate less inspection is required?
4. Does the current process have a low level of nonconformities?
5. Does the proposed process output rate affect inspection capabilities?
6. Was a gage R&R performed with personnel performing the inspection function?
7. Will the improved inspector process increase the ability to find nonconformities?
8. Will the process change reduce inspector escapes?
9. Has a cost analysis been performed (p<k1/k2, see Appendix B)?
10. Will the customer allow the change?

Fixed by Tool

Justification

Weight

- Manufacturing Process Change
- Inspection Process Change
- Management or Customer Input

User Modifiable

Return

1. Does not justify removal of inspection process
2. Additional data required before decision can be made
3. Data Justifies capabilities study for process modification
4. Justifies modification of inspection process
5. Justifies removal of inspection process

User Modifiable

Investment

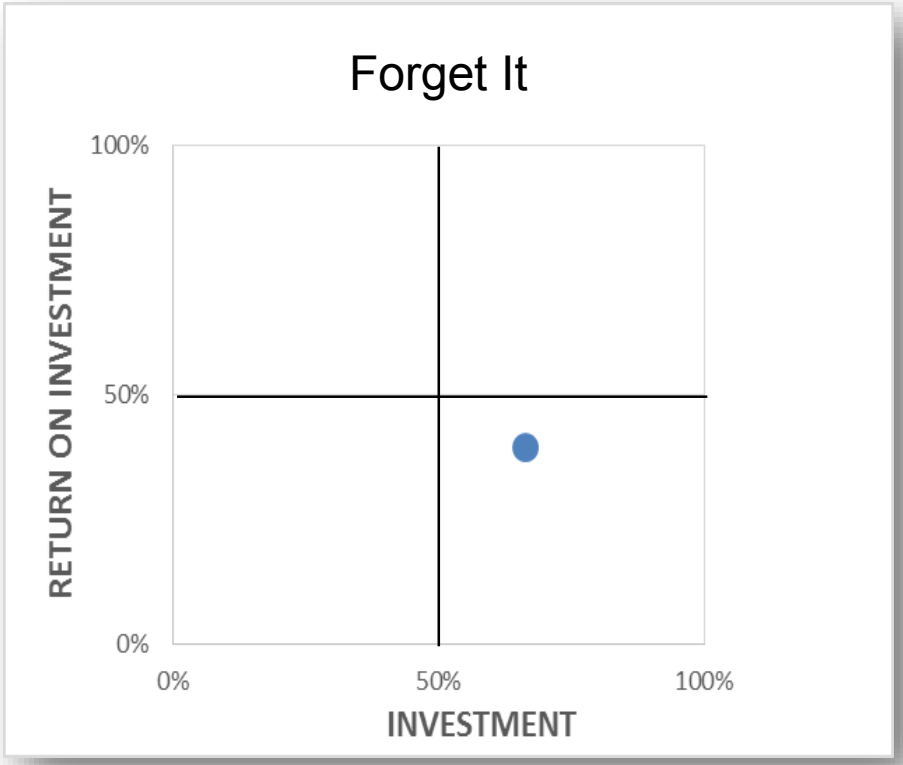
1. Low Effort (Easy or completed, limited personnel, <3 months)
2. Between Low and Medium
3. Medium Effort (Hurdles, somewhat difficult, >6 months)
4. Between Medium and High
5. High Effort (Complex, lots of people, >1 yr)

User Modifiable

Weighted results

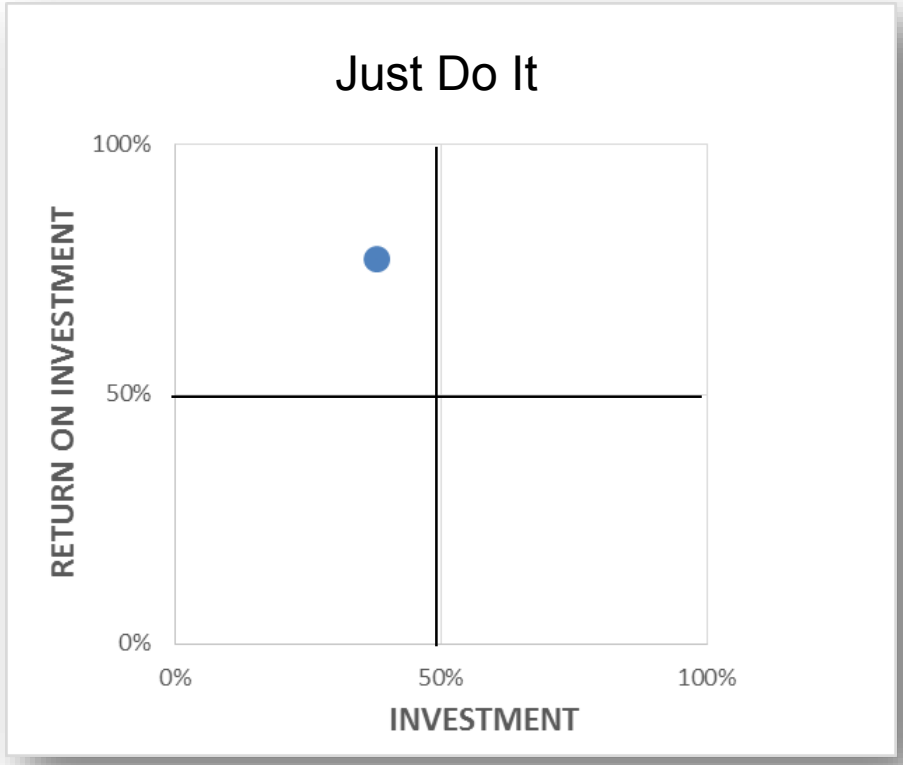
Additional Examples in Product

Torque Witness by Inspection Personnel



Evaluating whether or not to eliminate Inspection witness of "Torque" operations

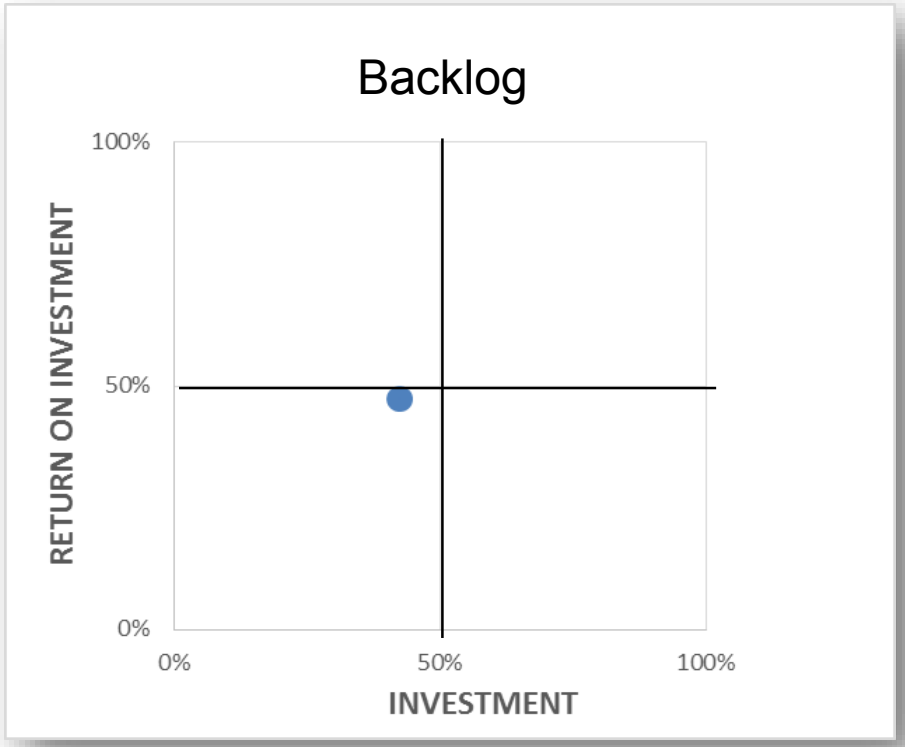
Test to flight (class 2) electrical mates



Elimination of a secondary inspection (by QA) for test to flight connector mates

Additional Examples in Product

Receiving Inspection of subcontracted products (QSI-1002)



Evaluating reduction in duplicative inspection efforts upon receipt for items that are Final Source Inspected

Examples of Each Potential Outcome

Target Audience and Intended Product Use

- Target Audience
  - *Quality organizations looking for efficiencies*
  - *Manufacturing organizations pursuing new technology*
  - *Stakeholders seeking ways to reduce non-value added costs*

- How Used
  - *Best applied early in change evaluation decision*
  - *Useful when many trades are possible*
    - Provides best indication of tradeoffs resulting from a proposed process change

Quality Deployment Team Membership

Core Team

First Name	Last Name	Organization
Art	McClellan	The Aerospace Corporation
Eli	**Minson**	**Ball Aerospace**
Frank	**Pastizzo**	**SSL**
Eric	**Richter**	**The Aerospace Corporation**
Jack	Harrington	Boeing
Jeanne	Kerr	Lockheed Martin
Dan	Gresham	Orbital
Dave	Martin	Raytheon
Brian	Reilly	DCMA
Daniel	Hyatt	MDA

Bold – co-leads

SME Team

First Name	Last Name	Organization
Kathy	Augason	Lockheed Martin
Kevin	Craig	SSL
Ken	Dodson	SSL
Frank	Fieldson	Harris
Edward	Gaitley	The Aerospace Corporation
Anthony	Gritsavage	NASA
Michael	Kelly	NASA
Neil	Limpanukorn	SSL
Michael	Phelan	DCMA
Robert	Pollard	Ball Aerospace
Thomas J.	Reinsel	Raytheon
Ric	Alvarez	Northrop Grumman
Dave	Newton	Northrop Grumman
Ethan	Nguyen	Raytheon

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Approved Electronically by:

Todd M. Nygren, GENERAL MANAGER
SYSTEMS ENGINEERING DIVISION
ENGINEERING & TECHNOLOGY
GROUP

Jacqueline M. Wyrwitzke, PRINC
DIRECTOR
MISSION ASSURANCE SUBDIVISION
SYSTEMS ENGINEERING DIVISION
ENGINEERING & TECHNOLOGY
GROUP

Catherine J. Steele, SR VP NATL SYS
NATIONAL SYSTEMS GROUP

Jackie M. Webb-Larkin, SECURITY
SPECIALIST III
GOVERNMENT SECURITY
SECURITY OPERATIONS
OPERATIONS & SUPPORT GROUP

SK0789

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Technical Peer Review Performed by:

Jacqueline M. Wyrwitzke, PRINC DIRECTOR
MISSION ASSURANCE SUBDIVISION
SYSTEMS ENGINEERING DIVISION
ENGINEERING & TECHNOLOGY GROUP

Eric S. Richter, ENGRG SPCLST SR
SYSTEMS AND OPERATIONS ASSURANCE DEPT
MISSION ASSURANCE SUBDIVISION
ENGINEERING & TECHNOLOGY GROUP

Arthur L. McClellan, DIRECTOR DEPT
SYSTEMS AND OPERATIONS ASSURANCE DEPT
MISSION ASSURANCE SUBDIVISION
ENGINEERING & TECHNOLOGY GROUP

Cheryl L. Sakaizawa, ADMINISTRATIVE SPEC III
MISSION ASSURANCE SUBDIVISION
SYSTEMS ENGINEERING DIVISION
ENGINEERING & TECHNOLOGY GROUP

SK0789