

Discrepancy Report Prioritization and Software Maintenance Impacts

Jenny Woolley
Kyle Thomas

SCEA 2012 – Orlando, FL



Table of Contents



- **Purpose of Research**
- **Discrepancy Report (DR) Definition**
- **DR Levels**
- **Analysis**
- **Conclusions**
- **Next Steps**

Purpose of Research

- **Current budget-constraints necessitate strategies for reducing costs in the Intelligence Community (IC)**
 - Cut or defer maintenance costs to avoid sacrificing new capabilities
 - Strategy frequently considered: Deferral of Discrepancy Report (DR) work-offs
 - DR defined as “a change made to software to correct a defect”¹
- **Research considers the cost and estimating impacts of deferring DR work offs in order to lower staffing levels**



¹Oman, Paul W., & Pfleeger, Shari Lawrence. *Applying Software Metrics*. Los Alamitos: Institute of Electrical and Electronics Engineers, 1997. p. 61.

Discrepancy Reports



- **DRs are a commonly accepted method for tracking custom software maintenance requirements in the IC and DoD**
 - DRs ranked according to severity by a panel/board
 - 1, 2, 3, etc.
 - A, B, C, etc.
- **DR data collection can be challenging**
 - Large DRs considered as maintenance or new development depending on WBS, Program Manager, or politics
 - Work may fall under multiple people

DR Levels



Level	Description
1	<u>Emergency</u> – Poses an imminent threat to system health, safety, or security. Takes precedence over all other work and justifies overtime (OT) if necessary. Default due date = 1 day.
2	<u>Urgent</u> – Poses a very significant limitation on an operational system function or performance. Is a priority for developers. Default due date = 3 days.
3	<u>Moderate</u> – A defect that prevents the system from performing as designed or intended. Some form of workaround may be available. Typically applied as an ad-hoc fix once available. Default due date = 14 days.
4	<u>Minor</u> – System functionality is impaired, but it does not impact current or near term activities. May be incorporated as an ad-hoc fix or be incorporated in the next block/release. Default due date = 30 days.
5	<u>Trivial</u> – Routine documentation update or development/ops defect that has only minor operational or development impact.
6	<u>Enhancement</u> – Minor enhancement or routine maintenance task. Completed as time and budget permit.

Analysis

Methods



- **Reviewed data from many government programs and narrowed sample down to 15 programs**
 - Includes programs for which complete date information was available

DR #	Description	Priority/Severity	Status	Defect Origin	Date Opened	Date Closed	Hours to Fix
A000156	Completion error message	2	Closed	West Coast	3/20/2009	4/7/2009	7.5

- Includes programs of varying age
 - Some programs performing DRs since 1999, others only for the last two years
 - Includes programs in both the acquisition and O&M timeframes
- Includes programs that provide a variety of capabilities
- Includes programs of varying size

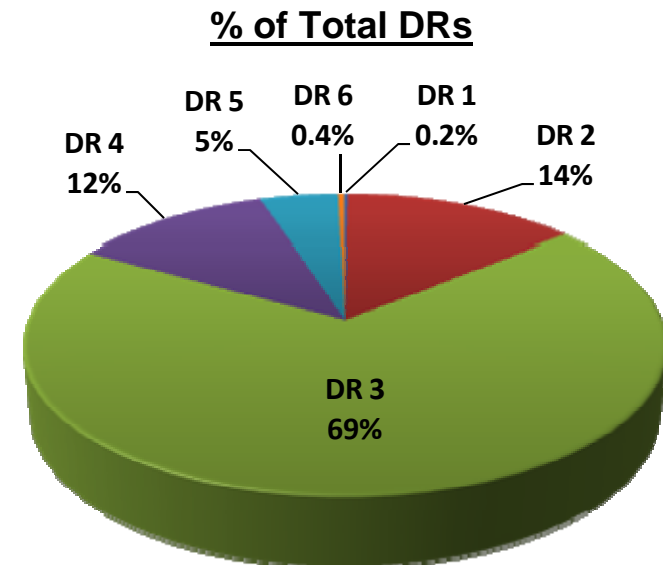
Number of DRs by Level



- **Majority of DRs are level 3**

- Level 3 DRs may not pose a direct threat to the mission, but they can affect mission support or make functioning more difficult
- Very few DRs categorized as Level 1 or 6
- Distribution relatively consistent across all programs analyzed

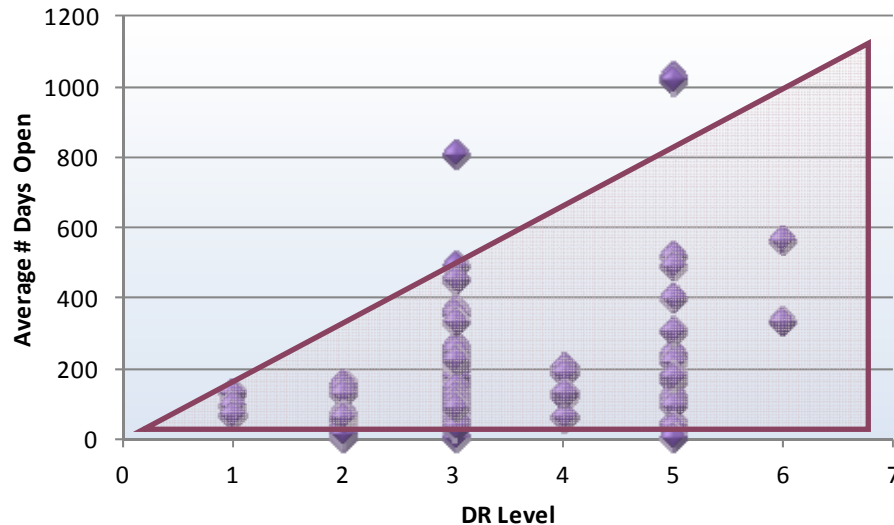
Level	Description
1	Emergency – Poses an imminent threat to system health, safety, or security
2	Urgent – Poses a very significant limitation on an operational system function or performance
3	Moderate – A defect that prevents the system from performing as designed or intended; workaround may be available
4	Minor – System functionality is impaired, but it does not impact current or near term activities
5	Trivial – Routine documentation update or development/ops defect that has only minor operational or development impact
6	Enhancement – Minor enhancement or routine maintenance task



Time to Close DRs



- **Average time to close a DR tends to increase as the DR level increases**
 - Experience a range for all levels due to variety of activities
 - Overall average number of days to close a DR = 164.3
 - Historical averages exceed suggested time for closing DRs

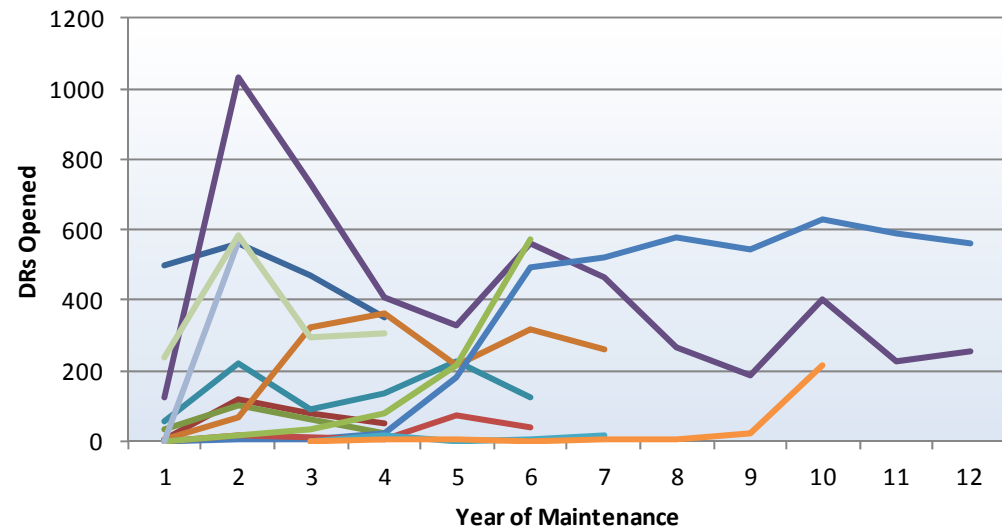


DR Level	Default Due Date (Days)	Average # Days to Close DR
1	1	95
2	3	65
3	14	185
4	30	135
5	N/A	280
6	N/A	450

Change in DRs Over Time



- **Change in the number of DRs over time was not consistent across programs**
 - Programs scheduled for retirement showed a decrease in DRs
 - Other programs, both in acquisition and O&M timeframes, displayed a variety of trends
 - Steady state
 - Peaks with new releases/security changes
 - Dramatic increase
 - No significant change in distribution of DR levels over time



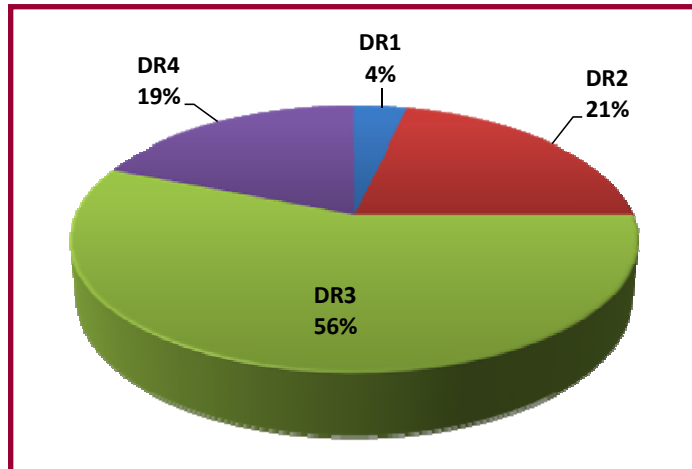
Program X

In-depth Analysis: Program X

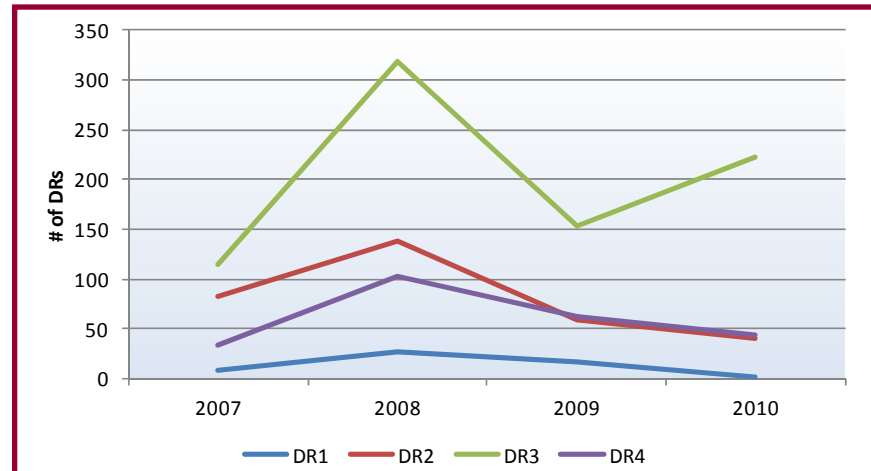


- **Single program provided data on the number of hours required to fix each DR**
 - Historical data available from 2007-2010
 - Program only experienced DRs ranging from Levels 1-4
 - Program is currently in a purely O&M state (i.e., no new development)
 - Program has proposed deferring/delaying lower priority DRs in order to accommodate budget constraints

Program X Details



DR breakout consistent with other programs analyzed



Decreasing DRs except for Level 3

Program X is consistent with other programs analyzed in terms of DR breakout and completion patterns

Priority	Program X Avg. # Days Open	General Avg. # Days Open
DR1	65.2	95
DR2	67.2	65
DR3	83.5	185
DR4	113.5	135

Behind schedule, but better than average completion time

Time to Fix vs. Time to Close



- **Program X demonstrates challenges with analyzing programs that do not record data on Time to Fix**
 - One Level 3 DR took 521.5 days to close, but only 3 hours to fix
 - Differences possibly due to
 - Optimal order for fixes
 - Staffing limitations
 - Etc.

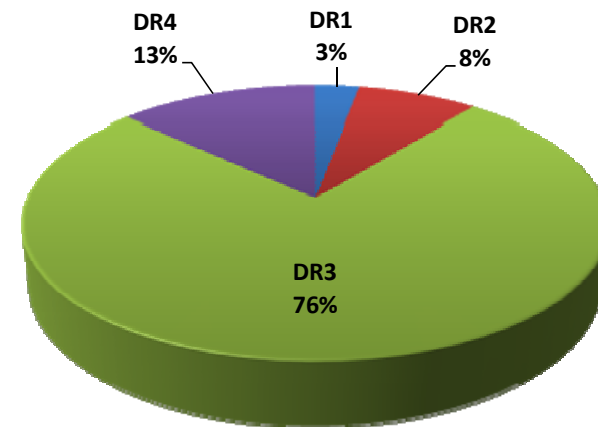
Priority	Avg. # Days Open	Avg. Hours to Fix
DR1	65.2	17.1
DR2	67.2	7.9
DR3	83.5	31.0
DR4	113.5	24.4

Increases steadily with DR Levels

Level 2 DRs require significantly less time than any other Level

Level 3 DRs are not only the most common, they also take the most time

% of Time Spent on DRs



Conclusions



Decreasing maintenance staffing and deferring the completion of DRs may lead to challenges in the future

- To date, there is no record of a program experiencing a devastating failure due to the deferral of DRs
 - Concern exists that delaying work will lead to spikes in maintenance further down the road
 - Conflicting opinions from industry
- Cannot assume number of DRs will decrease over time
- Leadership should ensure enough funding is available to satisfy at least Level 1 and 2 DRs, but funding at least a portion of Level 3 DRs is advisable

The unique characteristics and data limitations of each program make estimating by DR Levels difficult

- Different phasing and time required for DR completion
- Lack of available data on hours required to fix a DR prohibits effort calculations
- Blurred line between maintenance and new development
- Budgetary influences

Next Steps



- **Continue to follow the programs considered in this research, as well as new programs**
 - Obtain larger sample size
 - Consider programs as they enter O&M timeframes
- **Evaluate methods for calculating anticipated maintenance costs in conjunction with the IC SW Standards Study**
 - Because DRs vary significantly by program, individual program DR analysis may be more useful when combined with other methods for maintenance estimation

Contact Information



- Jenny Woolley: jennifgw@dni.gov
- Kyle Thomas: Kyle.D.Thomas@dni.gov

Recognition



- **Contributors**

- Will Black
- Paul Cymerman

- **Acknowledgments**

- Brian Wells
- Sandra Williams
- Tom Van Horn