

# Phase Containment Effectivity

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Background: Mid-1990s  
Motorola Transmission Products Business Unit

Revenues \$220 million / year  
Cash cow for the division  
About 100 software engineers; multi-sited  
Two major telecommunications product lines  
Box products for enterprise interconnect  
Embedded software, multi - 68xxx processors  
Custom digital signal processor technologies  
>90% of value in software  
Release projects lasted 9 - 12 months

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## Business Unit Development Maturity

Previously achieved CMM Level 2 assessment  
Code reviews were a standard practice  
QA was embedded within design team, but reported to another organization  
Testing was owned by engineering  
Mgmt. searching for ways to continuously improve

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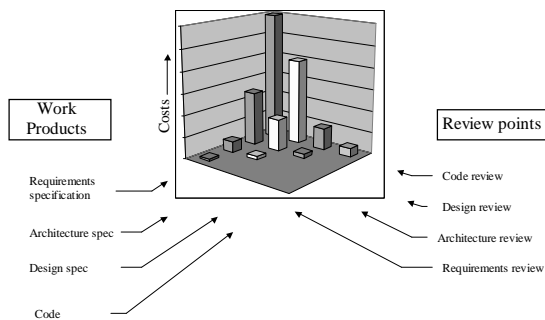
## How phase containment initiative was "sold"

Expected benefits of initiative  
More diligence on design work products  
Avoiding mistakes (vs. containment)  
Smoother system test phase  
Unexpected benefits of initiative  
Early visibility into project's outcome  
Better precision on release criteria  
(test coverage, outstanding defects, code stability)

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## Cost to fix problems

(Based on when the defect is created versus when its discovered)



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## Standard of Performance Requirements Specifications

Complete  
Unambiguous  
Testable ←  
Traceable  
Concise  
Independent of implementation  
Conformant to internal and external standards

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## Phase Containment Metric and Process

November 21, 2001

Project Reliant Release 4.0

Work Products	Phase Review Points							Total Errors	Total Defects	Total Faults	Phase Containment Effectivity
	Requirements Review	Architecture Review	Design Review	Code Review	Module Test	Integration Test	Alpha Test				
Requirements Specification	6	9	8	1	1	2	1	6	22	28	0.21
Architecture Spec		130	30	9	14	12	16	130	81	211	0.62
Design Spec			156	40	25	23	12	156	100	256	0.81
Code				117	63	13	6	117	62	120	0.66
Test Spec					24	5	2	24	7	31	0.77
Faults by Phase	6	139	194	167	107	55	37				

	Measured	Historical
In process Defects		272
In process Faults		705

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## Reviews

### Metrics per review

Number of people	Elapsed time
Work product size	Defect volume
Defect severity, location	Defect root cause

### Interpretation of results

- Review thoroughness and quality
- Project state
- Project compared to similar projects
- Project management responses

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## Another value of CMM activity General Dynamics Decisions Systems (360 software engineers)

CMM Level	Percent rework	Phase containment effectivity	CRUD density per KLOC	Productivity X factor (relative)
2	23.2%	25.5%	3.2	1 x
3	14.3%	41.5%	.9	2x
4	9.5%	62.3%	.22	1.9 x
5	6.8%	87.3%	.19	2.9 x

Source: King, Diaz, *Crosstalk: The Journal of Defense Software Engineering* March 2002

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## Smoother entry into final testing

### Concise requirements (testability)

### Review-able final test planning

Agreement on test sequencing vs. build

Agreement on regression sampling "

### Agreement on coverage objectives

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## Better final test planning

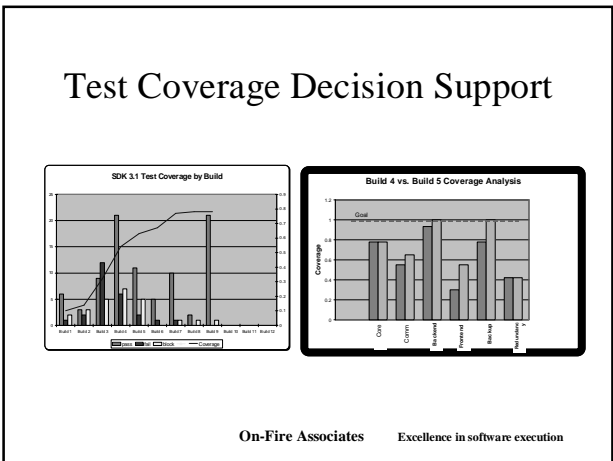
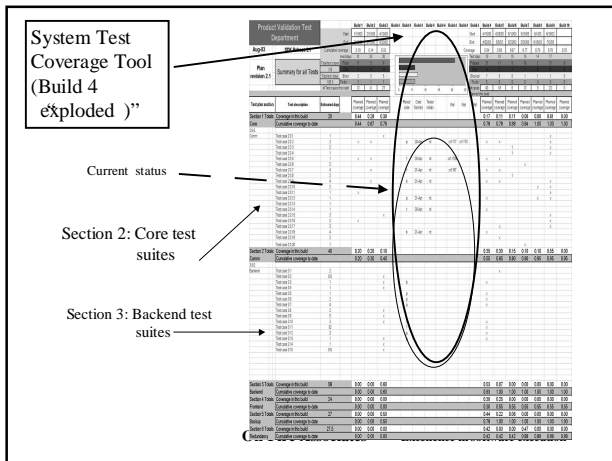
*The plan is nothing, planning is everything "*

Dwight David Eisenhower

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## System Test Coverage Template

Product Validation Test Department		Build 1	Build 2	Build 3	Build 4	Build 5	Build 6	Build 7	Build 8
		Start	2/19/03	2/19/03	2/19/03	2/19/03	2/19/03	2/19/03	2/19/03
		End	2/19/03	3/19/03	4/30/03	4/29/03	5/03	5/29/03	5/29/03
Aug-03	SDK Release 3.1	Cumulative coverage	0.10	0.14	0.32	0.54	0.63	0.67	0.77
		Total test cases	31	33	20	10	15	15	14
		# Test cases this build	6	3	9	21	11	5	10
Plan revision 2.1	Summary for all Tests	125	125	125	125	125	125	125	125
		# Test cases this build	2	3	5	7	5	0	1
		Planned coverage	0.00	0.00	0.00	0.30	0.55	0.55	0.55
		Planned coverage	0.42	0.9	0.27	0.40	0.18	0.6	0.3
Test plan section	Test description	Estimated days	Planned coverage	Planned coverage	Planned coverage	Planned coverage	Planned coverage	Planned coverage	Planned coverage
Section 1 Totals	Coverage in this build	20	0.44	0.28	0.39	0.17	0.11	0.11	0.06
Core	Cumulative coverage to date		0.44	0.67	0.78	0.78	0.78	0.89	0.94
Section 2 Totals	Coverage in this build	40	0.20	0.20	0.10	0.35	0.30	0.15	0.10
Comm	Cumulative coverage to date		0.20	0.30	0.40	0.55	0.65	0.80	0.95
Section 3 Totals	Coverage in this build	58	0.00	0.00	0.60	0.53	0.07	0.00	0.00
Backend	Cumulative coverage to date		0.00	0.00	0.60	0.93	1.00	1.00	1.00
Section 4 Totals	Coverage in this build	24	0.00	0.00	0.00	0.30	0.25	0.00	0.00
Frontend	Cumulative coverage to date		0.00	0.00	0.00	0.30	0.55	0.55	0.55
Section 5 Totals	Coverage in this build	27	0.00	0.00	0.50	0.44	0.22	0.06	0.00
Backup	Cumulative coverage to date		0.00	0.00	0.50	0.78	1.00	1.00	1.00
Section 6 Totals	Coverage in this build	27.5	0.00	0.00	0.00	0.42	0.00	0.00	0.47
Redundancy	Cumulative coverage to date		0.00	0.00	0.00	0.42	0.42	0.42	0.89



## Did it matter ?

*“Innovation is creativity that ships ” Steve Jobs*

- Higher quality and more predictable releases
- Early visibility into project s likely outcome (after the first few iterations)
- Consistency was important
- Postmortems found engineers were more effective and happier

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One solid measurement is worth a thousand expert opinions ”

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