



**NORTHROP GRUMMAN** DEFINING THE FUTURE  
*Space Technology*

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# Process Based Organizational Transformation

Lean Aerospace Initiative Plenary Conference

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# Northrop Grumman Space Technology

- A leading producer of satellite, laser, electronic systems, and CNI avionics
- 2003 sales of \$2.8B
- 9000 employees
- Headquartered in Redondo Beach, CA

• 50+ % Engineers and Scientists  
• 27% Advanced Degrees



Defense Support Program

Milstar Payloads



Advanced EHF Payloads



Space Tracking and Surveillance System



Integrated Communications, Navigation, and Identification Avionics (ICNIA)



Airborne Laser



Tactical High Energy Laser

Joint Strike Fighter Avionics



Comanche Integrated CNI and EW

Earth Observing System



Tracking and Data Relay Satellites

F-22 Raptor ICNIA



Environmental Research Satellites

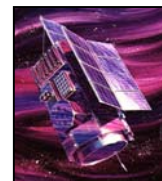


Pioneer 10



INTELSAT III

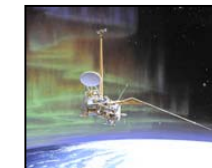
High Energy Astronomy Observatories



Gamma Ray Observatory



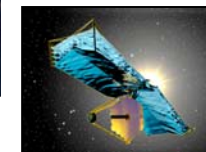
Chandra X-ray Observatory



National Polar-orbiting Operational Environmental Satellite System



Orbiting Geophysical Observatories



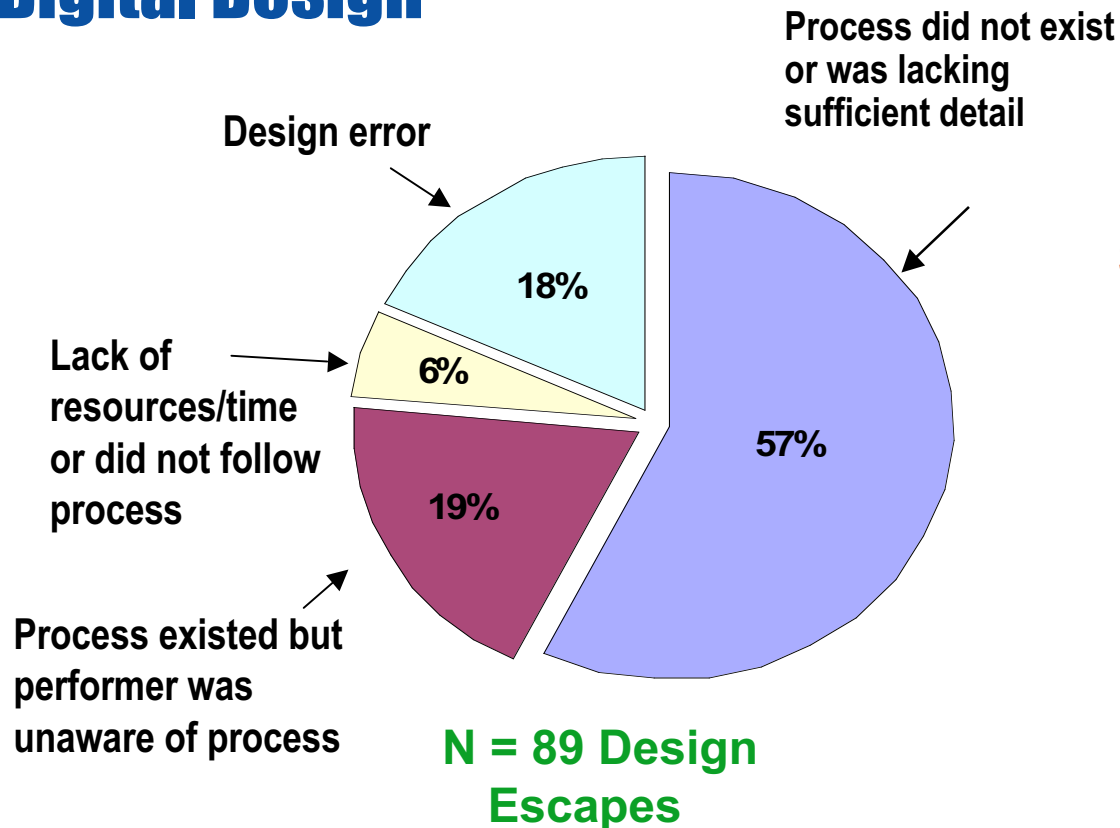
James Webb Space Telescope

# Elements of Transformation

- **Understanding - - How to Leverage Process Improvement in an Engineering Environment**
- **Process Emphasis - - Reducing Defects for Mission Success**
- **Ownership / Accountability - - Proper Organizational Structure**
- **Definition - - What Are the Engineering Processes?**
- **Strategic Objectives - - What Do We Measure?**
- **Identify Platform - - Communication Framework to Drive Process Standardization and Improvement**
- **Culture Change - - Incorporating Process Mindset Into Organizational Operations**
- **Using the Results - - Overcome Resistance**

*Process focus is a precursor to process improvement*

# Post Cycle Engineering Defects— Digital Design



## Summary Root Causes

- Lack of clear standard design process
- Insufficient process compliance accountability and enforcement requirement
- Ineffective design reviews

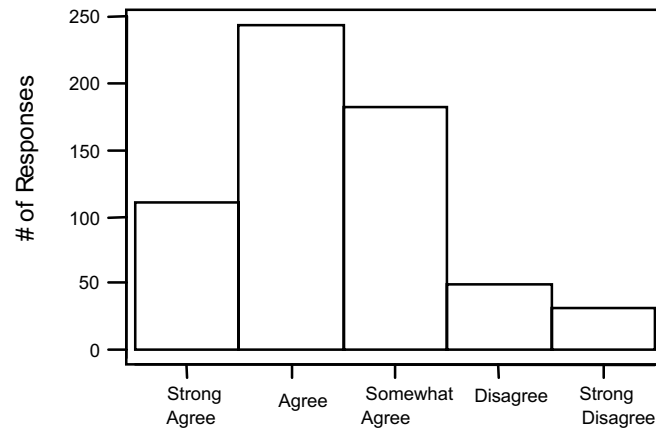
*Root cause analysis showed 82% of design escapes attributed to “no established process” or “process non-compliance”*

# Design Time Defects

*Do engineers often create something that they know exists but cannot find ?*

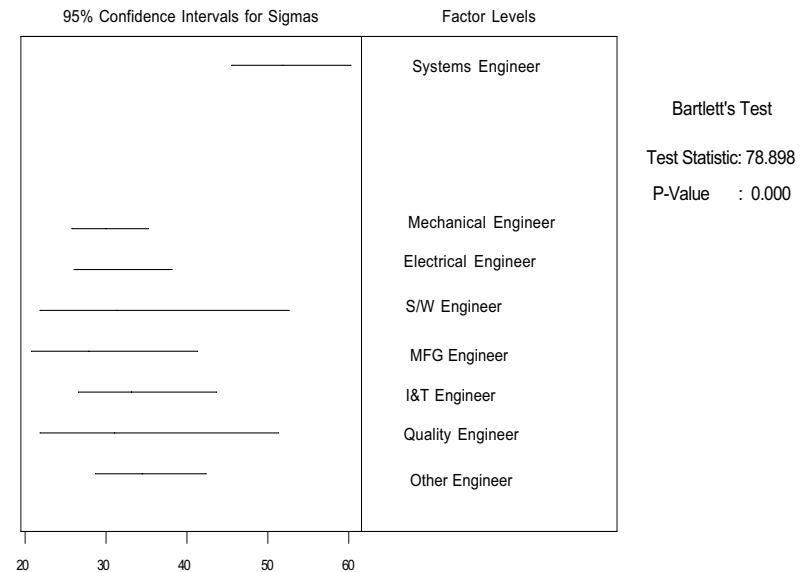
**84.3%** of engineers strongly agree/agree/somewhat agree that they do

*I often create something that I know or suspect already exists but cannot find.*



*Data reveals that systems engineering spend the most time searching for information*

Test for Equal Variances for Total - hrs\_



***Engineers can spend up to 40% of their time searching for information***

# Process Based Business Approach

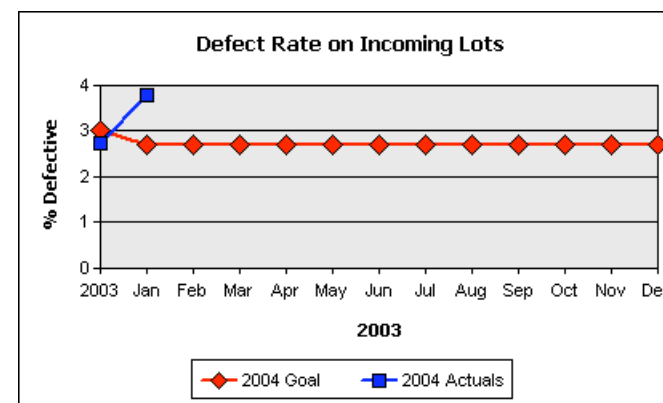
## Step 1 - - Establish core processes used uniformly on all activities

- Define the process
- Document the process
- Communicate the process
- Measure process performance
- Establish process owner
- Enforce the process

Level	Process	Process Owner	Define	Documented	Communicated	Measured	Enforced	Overall
1	Engineering	D. DiCarlo	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow
2	System Engineering	J. Daegelé	Yellow	Yellow	Yellow	Green	Red	Yellow
3	Mission Engineering	S. Lunny	Green	Green	Yellow	Green	Red	Yellow
2	Electrical	R. Smith	Green	Green	Yellow	Yellow	Yellow	Yellow

## Step 2 - - Improve the process

- Identify gaps in performance
- Utilize process improvement methodologies



# Recent Successes

ASIC	No of Defects Detected	Root Cause of Defects Found	Re-Spins Avoided	Minimum Cost and Schedule Savings
MCA	13	Incomplete Verification	Multiple	> \$3M 12-18 months
HAL	20	Incomplete Verification	Multiple	> \$3M 12-18 months
PCI Bridge	28	Incomplete Verification	No (SW fixes)	> \$0.5M 6-8 months
CPA	12	Incomplete Verification	Multiple	> \$3M 12-18 months

***Multiple improvement projects improved the ASIC process saving at least \$9.5M***

# Process Management in Review

Level	Process	Overall	Process	Checklist	Standards	Review	Enforce
1	Engineering	2.09	2.01	1.97	1.98	2.44	1.75
2	1 - System Engineering	1.80	2.11	1.25	1.55	3.00	1.09
2	2 - Electromechanical	1.92	2.14	1.91	1.95	1.94	1.66
2	3 - Electrical	1.96	2.15	1.60	1.84	2.15	1.79
2	4 - Microelectronics	2.68	2.86	2.81	2.59	2.68	2.46

SPONSOR COORDINATING PROCESS

SEARCH FOR: [Select Column]

FULL TEXT SEARCH: [Filter by Theme]

SORT BY: [Select Column]

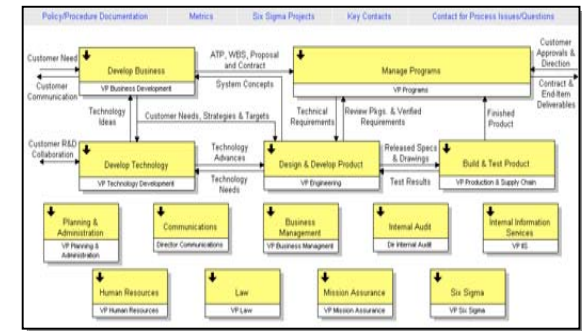
Current Sort by Project Number Descending

PROJECT TYPE	PROJECT NAME	WAVE	SECTORS	COORDINATOR	MASTER BLACK BELT	PROJECT LEAD	START STATUS	PHASE STATUS	PROJECT START DATE	ACTUAL/MASTER CONTROL PHASE START DATE	PROJECT DETAILS
001	Improve Medical Loans Processes	Human Resources	Process Area	Jamal, Dae (118300)	Maur, Dae (112005)	Maur, Dae (112005)	E	Define			EXPANDED
001	Improve the ERP Process	Programs	Six Sigma	Six Sigma (10980)	Wong, Paul (94247)	Adams, Gene (79957)	E	Define			EXPANDED
001	Testing	Space Technology	ADL			Carmichael, Charles (117193)	D	Define			EXPANDED
001	Improve Performer Cost Estimating/Support Process	Finance & Business	Process Area		Ung, Wayne (100800)	Choi, Chuck (10050)	F	Define	4/28/2003		EXPANDED
001	Verification Risk Management	Engineering	ADP	Shelby, Ed (117200)	Terry, Darv (10295)	Terry, Darv (10295)	E	Define			EXPANDED

Process Defined & Characterized

Improvement Projects

Process Value Stream



Dashboards Developed & Metrics Collected

Process Documented with "Easy Access"

