



NAVAIR Process Resource Team

Evolving Postmortems as Teams Evolve Through TxP

November 2014

**NAVAIR Public Release 14-0030
Approved for Public Release**



Agenda

- NAVAIR
- Team Process Integration (TPI)
- Team "X" Process (TxP)
- Time-Based Postmortem
- Size-Based Postmortem
- Quality-Based Postmortem



NAVAIR

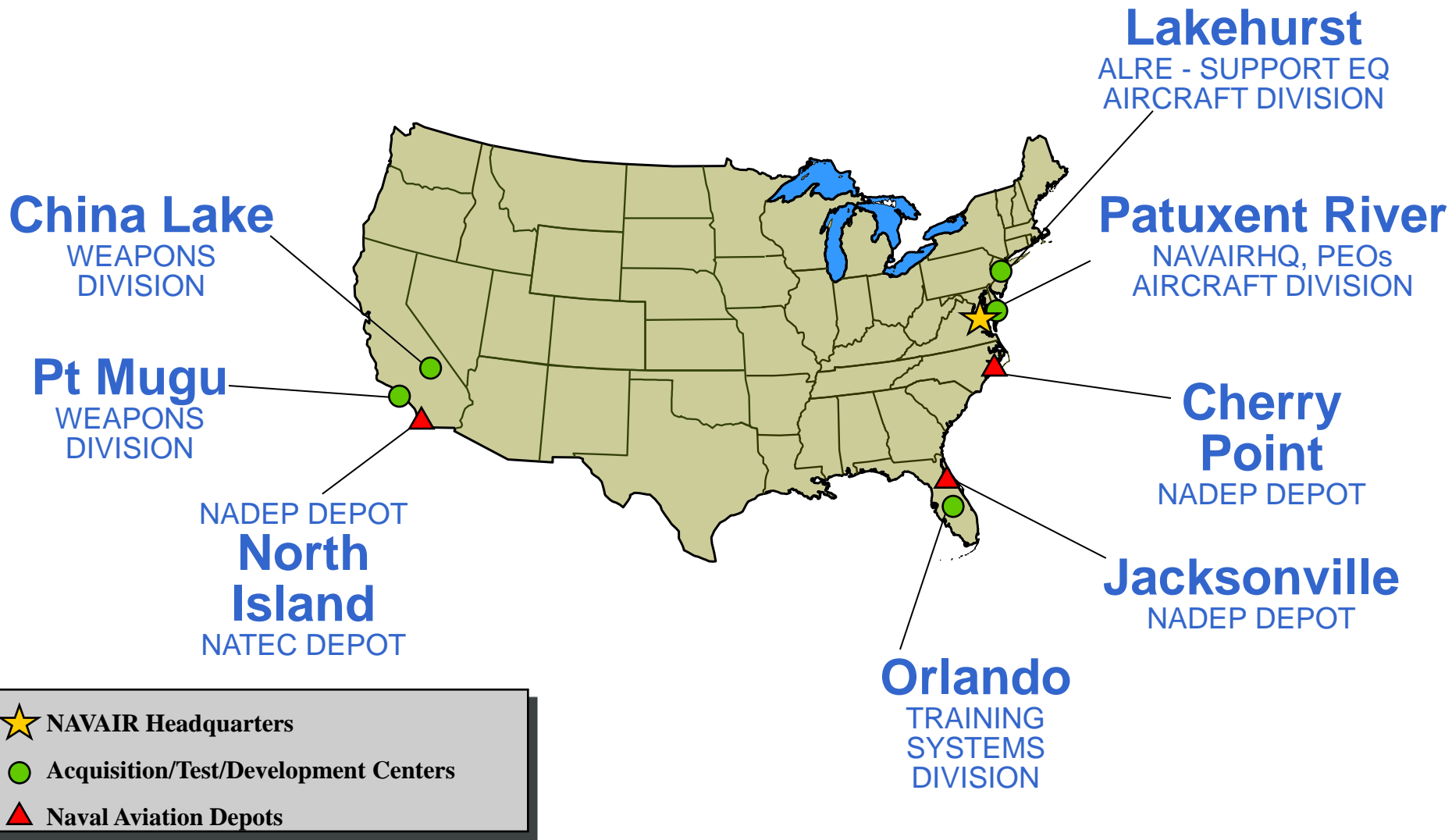


What is NAVAIR?

- NAVAIR is the **Naval Air Systems Command**
- Develop, acquire, and support the **aircraft** and related **weapons** systems used by **U.S. Navy and Marine Corps**
- Our **goal is to provide the fleet with quality products** that are both **affordable** and **available** when most **needed**
- Our support extends across the **entire life span** of a product, including all **upgrades and modifications** to that product



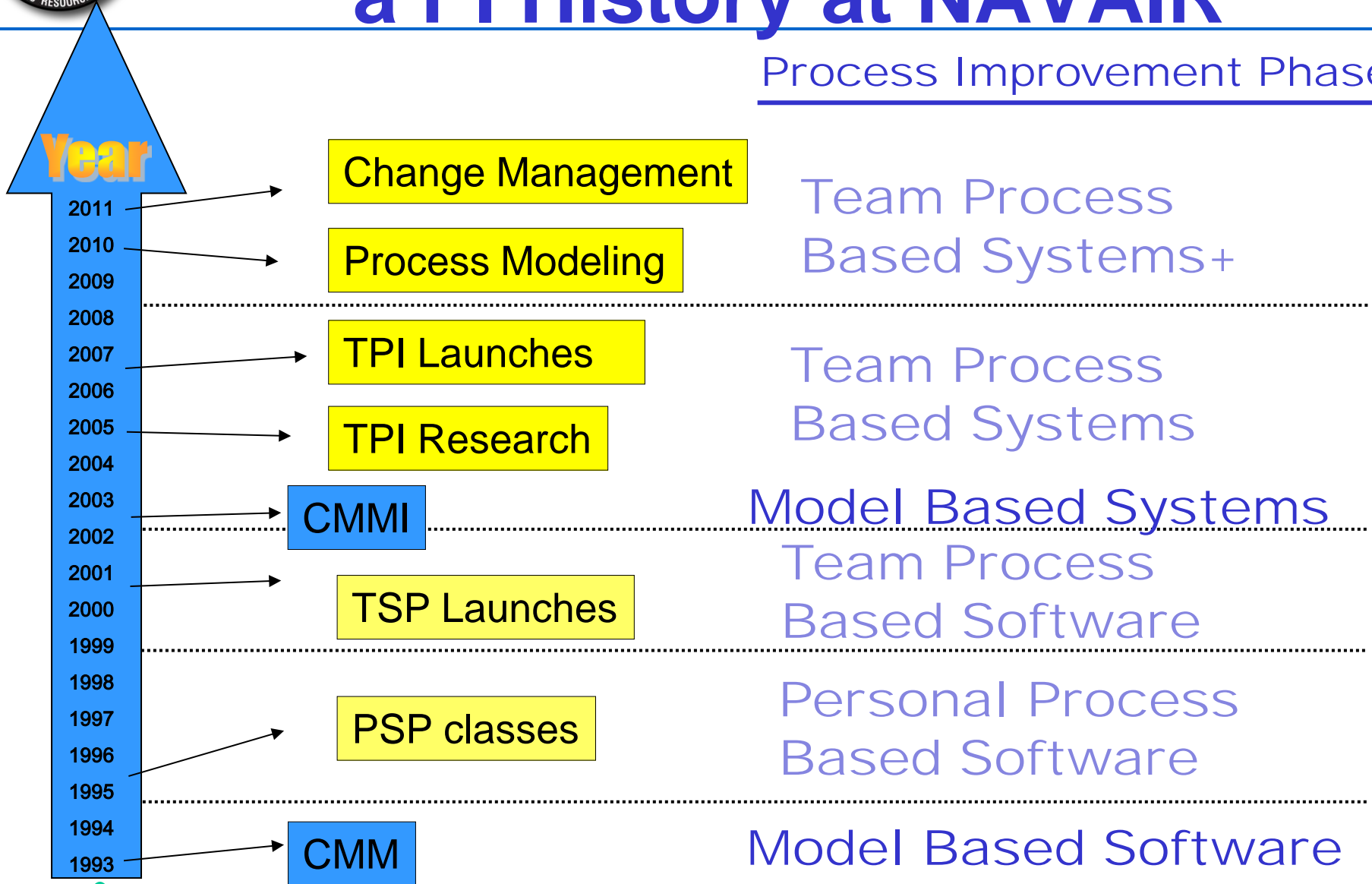
Where is NAVAIR?





Process Resource Team – a PI History at NAVAIR

Process Improvement Phase





Team Process Integration (TPI)



Models and Processes

Capability Maturity Models:

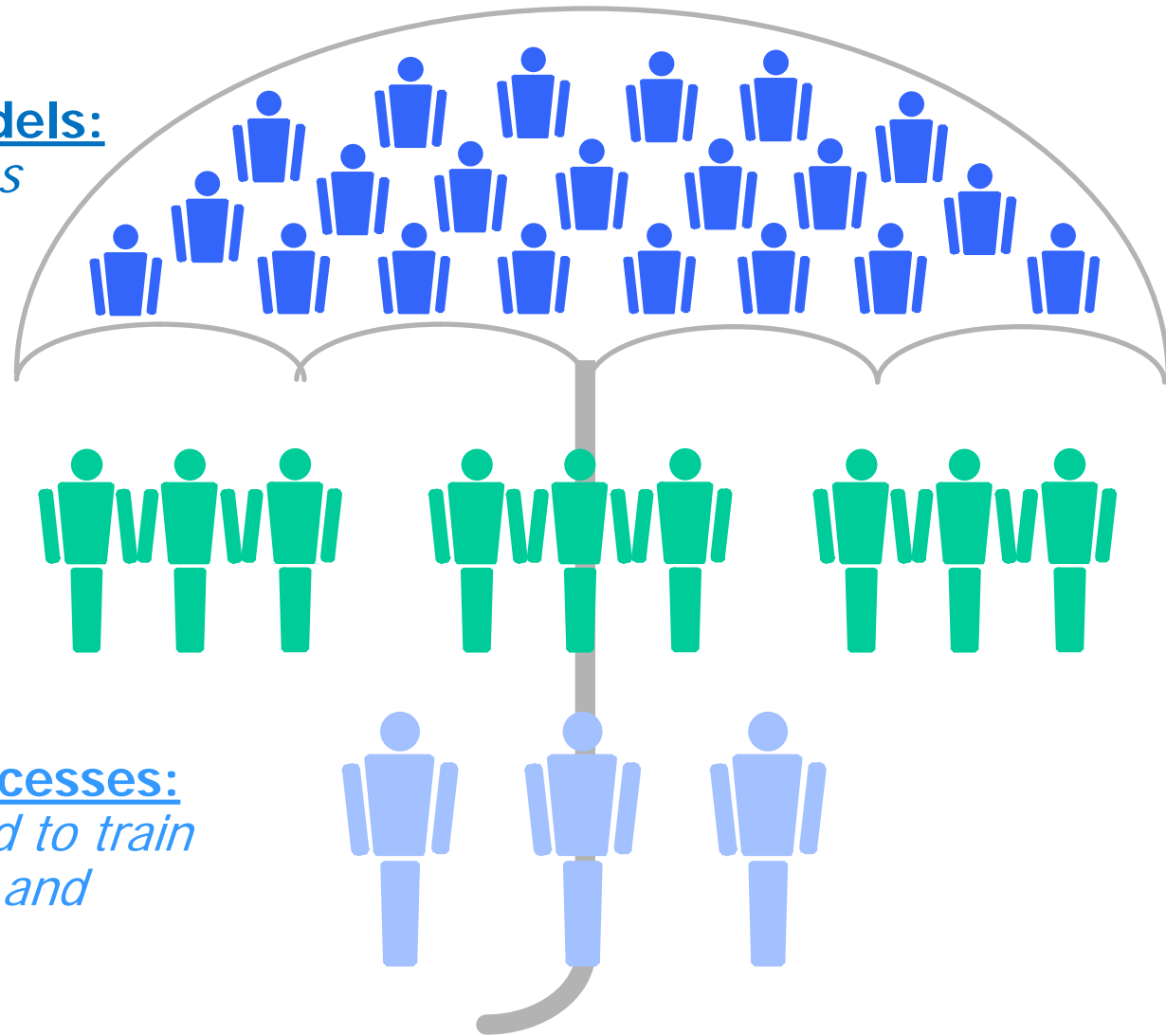
Reference for organizations building process capability

Team Processes:

Processes for teams building quality products on cost and schedule

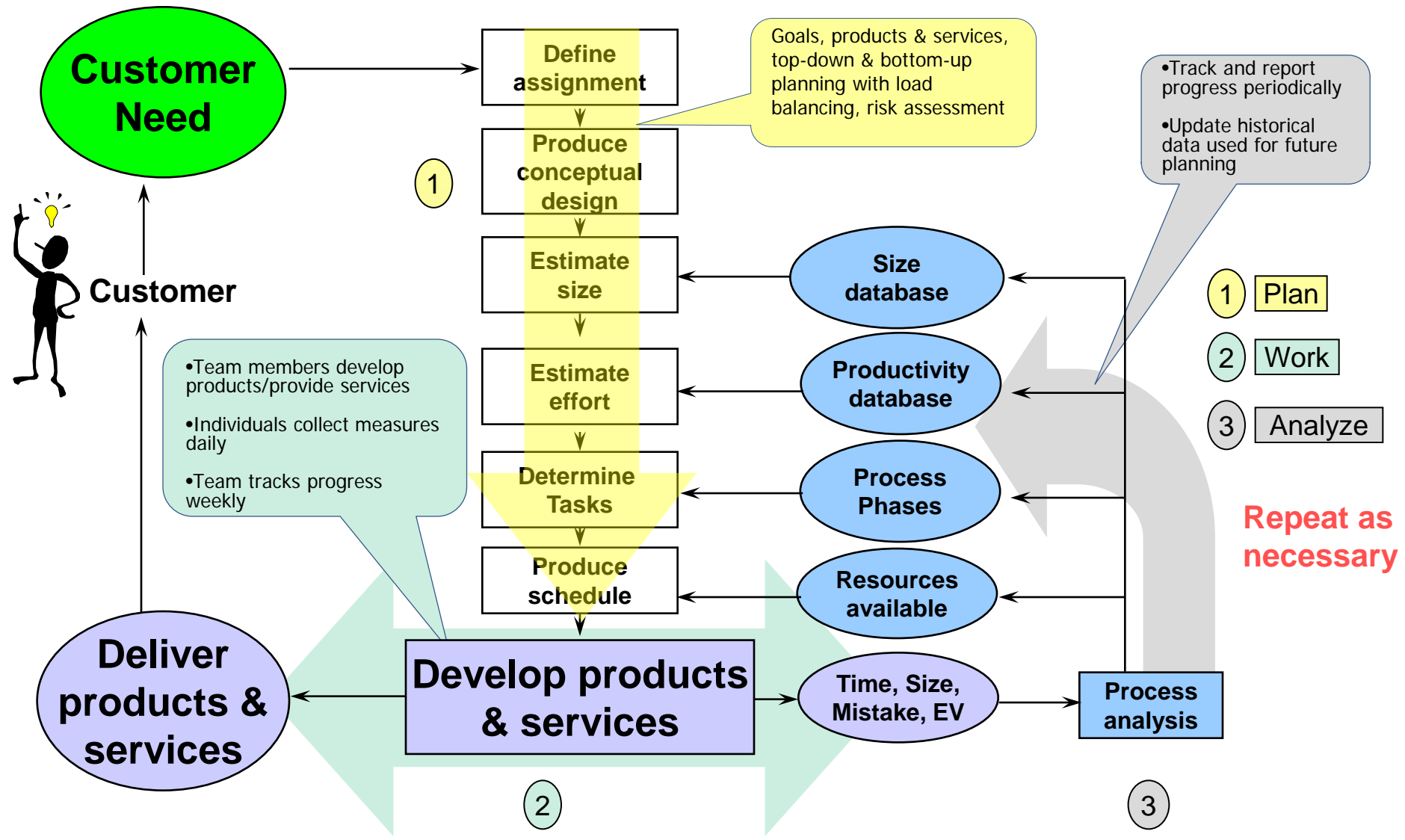
Personal Processes:

Processes used to train individual skill and discipline





Key Team Process Framework

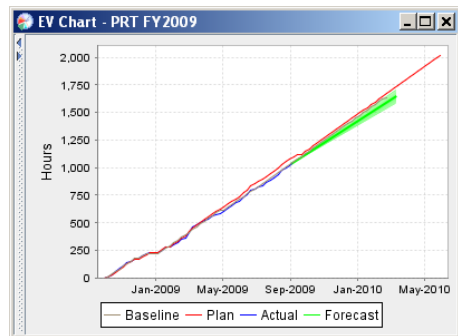
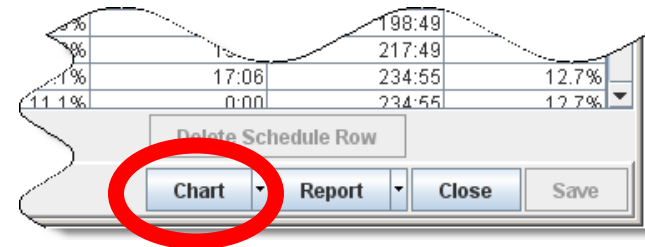




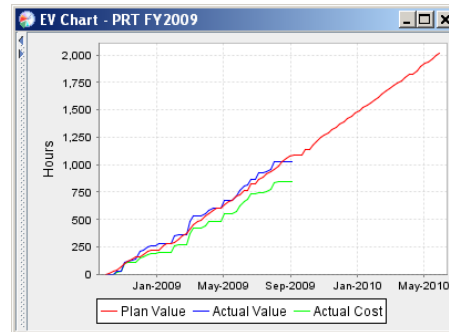
Team Measures and Metrics

- Each team member gathers four basic measures
 - Times
 - Sizes
 - Mistakes
 - Task completion dates

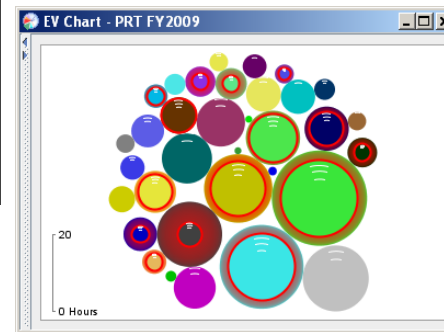
Charts and tables of project metrics are available (updated in real time)



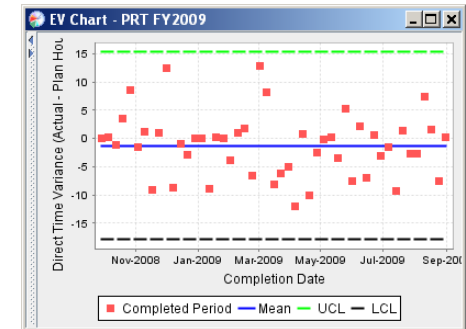
Direct Hours



Earned Value



Tasks in Progress



many more...



NAVAIR TPI

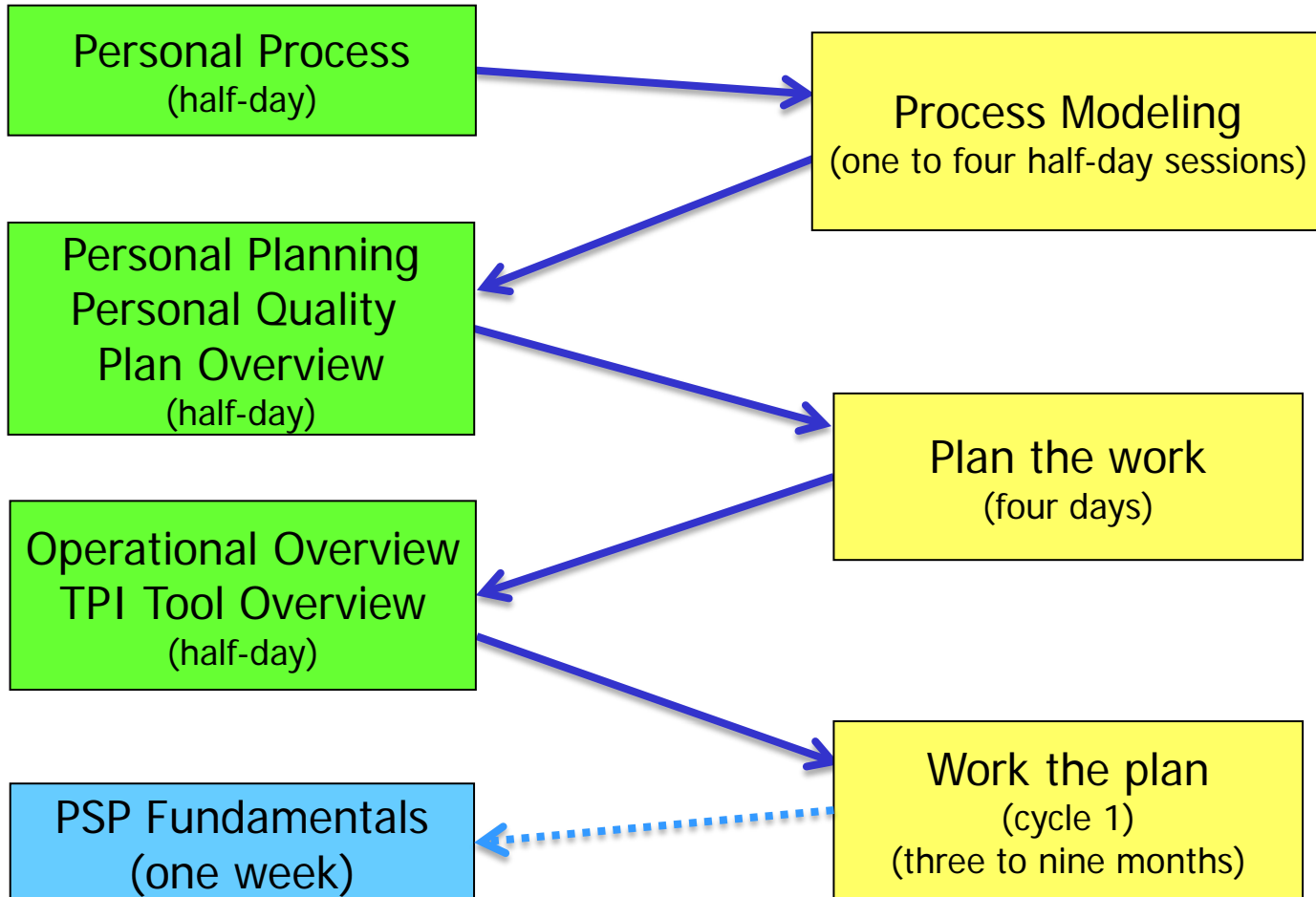
- Success of software teams using TSP led their organizations to ask for same performance on other teams
 - Worked with the SEI to develop approach
 - Based on same TSP fundamental principles
- NAVAIR approach has become TPI for all teams
 - Teams plan all work from first launch forward
 - Work is based on all products and services defined in process modeling
 - PSP for Engineers training planned as part of project if appropriate



Just-in-Time TPI Training

Learning

Doing





Team [topic-name] Process (TxP)



TPI **Pluses** & **Minuses**

- + A detailed plan!
- + Ability to track progress (weekly)
- + Improved estimating (over cycles)
- No mature processes
 - “Where do we put mistake-fixing phases?”
- No defect type standards
 - “What kinds of mistakes do I make?”
- No quality planning
 - “Will our plan produce a good product?”
 - No quality indicators (e.g., A/FR)



CMMI, TSP & PSP Relationship

???

TRP *Is*
(Rqmts) *icts*
d

T
(S/W)

T TTP
(Sys Test)



T x P

PRP *Is*
(Rqmts) *kill*
ne

P PTP



P x P

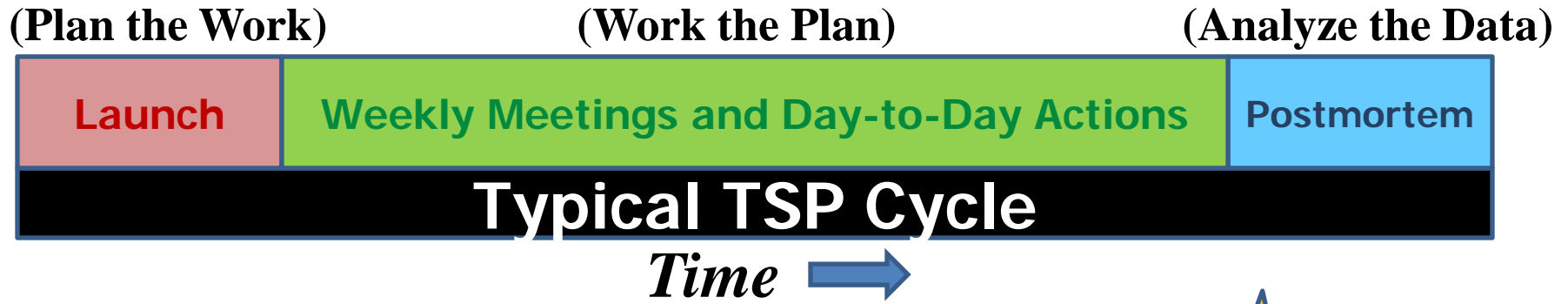


TPI is Only a Waypoint

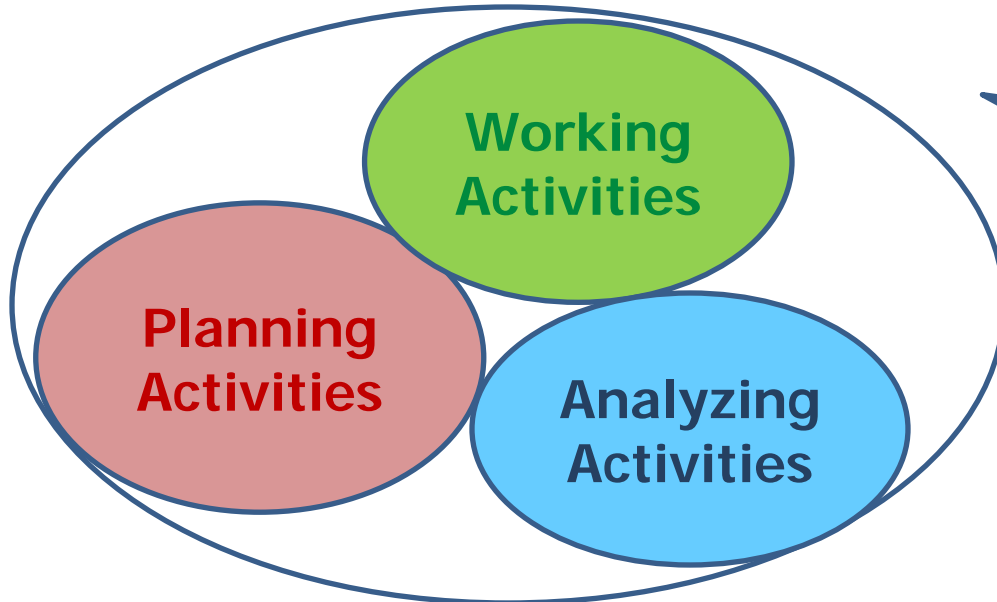
- TPI teams will hit a glass ceiling
- TPI teams need to evolve to achieve TSP-like performance (become a TxP team)
- What else does a TPI team have to do in order to become a TxP team?
- *What does a TSP team do?*



What Does a TSP Team Do?



TSP Activities



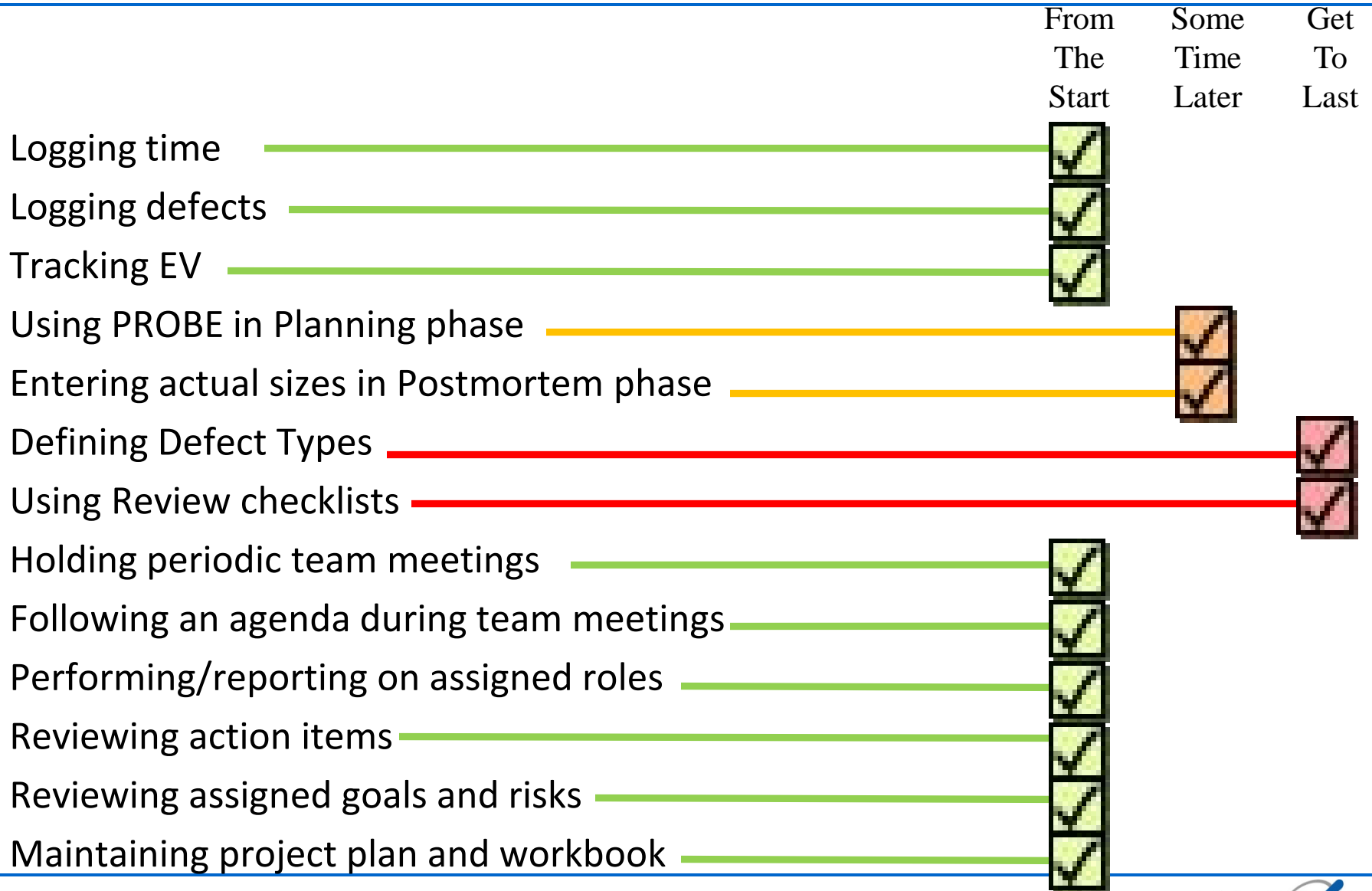


TxP Planning Activities

	From The Start	Some Time Later	Get To Last
Project and Management Objectives	<input checked="" type="checkbox"/>		
Team Goals and Roles	<input checked="" type="checkbox"/>		
Project Strategy and Support	<input checked="" type="checkbox"/>		
Overall Plan	<input checked="" type="checkbox"/>		
Planned sizes and rates used to compute times		<input checked="" type="checkbox"/>	
Quality Preparation	<input checked="" type="checkbox"/>		
Planned Defects Injected/Removed			<input checked="" type="checkbox"/>
Planned quality indicator values are acceptable			<input checked="" type="checkbox"/>
Balanced Plan	<input checked="" type="checkbox"/>		
Project Risk Analysis	<input checked="" type="checkbox"/>		
Launch Report Preparation	<input checked="" type="checkbox"/>		
Management Review	<input checked="" type="checkbox"/>		
Launch Postmortem	<input checked="" type="checkbox"/>		



TxP Working Activities





TxP Analyzing Activities

	From The Start	Some Time Later	Get To Last
Evaluate plan vs. actual schedule hours	<input checked="" type="checkbox"/>		
Evaluate plan vs. actual component hours	<input checked="" type="checkbox"/>		
Evaluate plan vs. actual component sizes		<input checked="" type="checkbox"/>	
Evaluate team performance vs. goals and quality plan			<input checked="" type="checkbox"/>
Evaluate plan vs. actual quality of components			<input checked="" type="checkbox"/>
Update planning data for schedule hours	<input checked="" type="checkbox"/>		
Update planning data for lifecycle time-in-phase %s	<input checked="" type="checkbox"/>		
Update planning data for productivity rates		<input checked="" type="checkbox"/>	
Update planning data for defect densities		<input checked="" type="checkbox"/>	
Update planning data for defect rates and yields		<input checked="" type="checkbox"/>	
Update planning data for quality indicator thresholds			<input checked="" type="checkbox"/>



Transitions

Training & First Launch

- ✓ 3-part TPI Training
- ✓ Process Modeling
- ✓ First Launch

Product Size Definition

- ✓ Define size measures
- ✓ Add Planning and Postmortem phases
- ✓ Begin use of PROBE

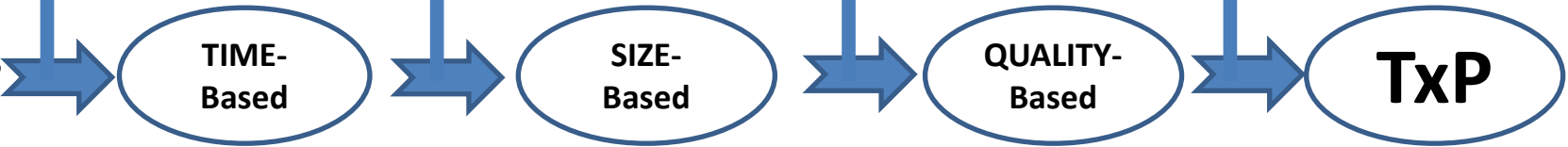
Defect Removal

- ✓ Define Defect Types
- ✓ Refine Processes with Defect Removal Phases

Quality Indicators

- ✓ Define Product Quality Indicators
- ✓ Define Process Quality Indicators

Stages



Planning Activities

Working Activities

Analyzing Activities





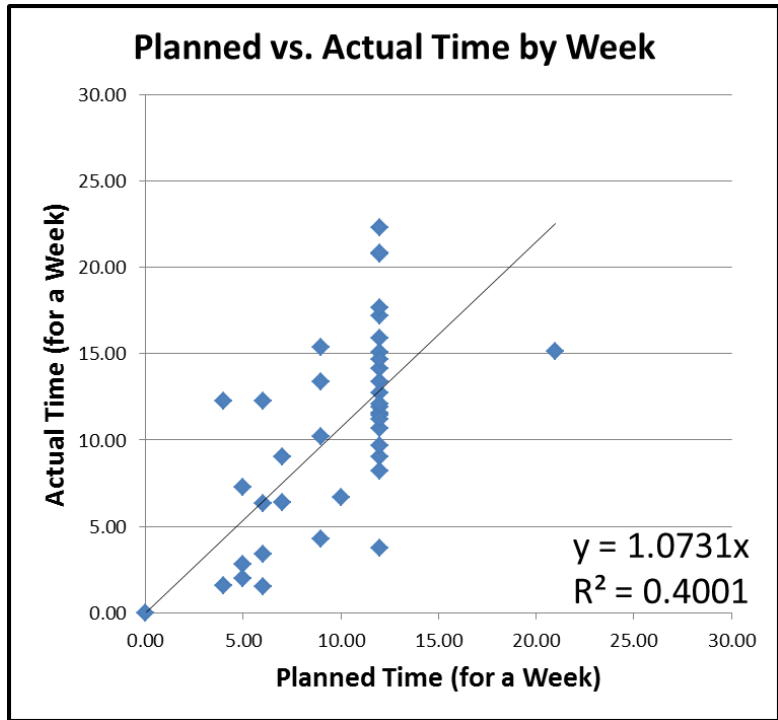
Time-Based Postmortem

- The team's most consistent data at first is time
 - Time on Task by Team Member
 - Planned vs. Actual Time by Component
 - Planned vs. Actual Time by Product/Service Type
 - Planned vs. Actual Time by Workflow
- Sample Time Log

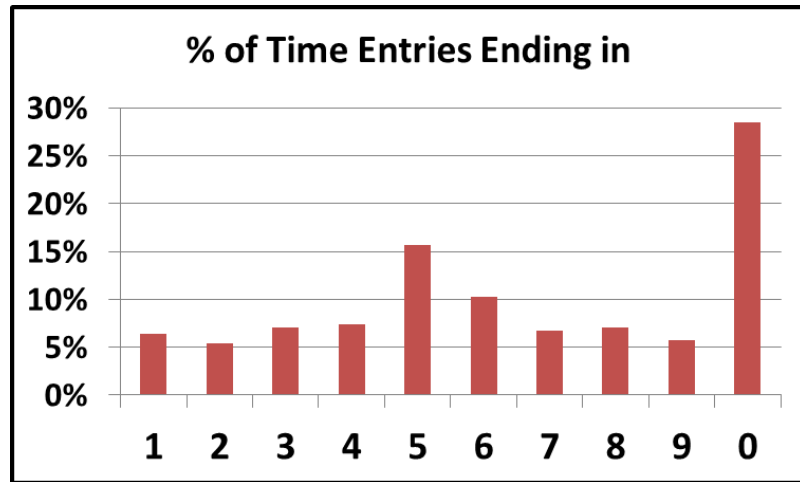
Logged To	Start Time	Delta
/Project/PRT FY2014/Common/Monthlies/Oct 2013/TPI Coaching/AV-8B SW/Do	Tue Oct 08 08:00:52 PDT 2013	0:10
/Project/PRT FY2014/TPI/Checkpoints/H-1 SIT - Aug 2013 part 2/Follow-up	Tue Oct 08 08:20:49 PDT 2013	0:17
/Project/PRT FY2014/TPI/Checkpoints/H-1 SIT - Aug 2013 part 2/Follow-up	Tue Oct 08 08:45:47 PDT 2013	0:05
/Project/PRT FY2014/TPI/Checkpoints/H-1 SIT - Aug 2013 part 2/Follow-up	Tue Oct 08 09:08:18 PDT 2013	0:21
/Project/PRT FY2014/TPI/Checkpoints/H-1 SIT - Aug 2013 part 2/Follow-up	Tue Oct 08 10:00:13 PDT 2013	0:05
/Project/PRT FY2014/Common/Monthlies/Oct 2013/TPI Coaching/Informal/Do	Tue Oct 08 10:17:40 PDT 2013	0:10
/Project/PRT FY2014/TPI/Checkpoints/H-1 SIT - Aug 2013 part 2/Follow-up	Tue Oct 08 10:29:44 PDT 2013	0:10
/Project/PRT FY2014/TPI/Checkpoints/H-1 SIT - Aug 2013 part 2/Follow-up	Tue Oct 08 10:54:50 PDT 2013	0:07
/Project/PRT FY2014/TPI/Checkpoints/H-1 SIT - Aug 2013 part 2/Follow-up	Tue Oct 08 11:23:09 PDT 2013	0:12
/Project/PRT FY2014/Common/Monthlies/Oct 2013/TPI Coaching/AV-8B SW/Do	Tue Oct 08 13:53:34 PDT 2013	0:07
/Project/PRT FY2014/Common/Monthlies/Oct 2013/TPI Coaching/CEI SSAT/Do	Tue Oct 08 14:01:02 PDT 2013	2:16
/Project/PRT FY2014/Common/Monthlies/Oct 2013/TPI Coaching/CEI SSAT/Do	Tue Oct 08 16:59:59 PDT 2013	0:33
/Project/PRT FY2014/Common/Monthlies/Oct 2013/TPI Coaching/CEI SSAT/Do	Tue Oct 08 17:44:18 PDT 2013	0:42
/Project/PRT FY2014/Common/Monthlies/Oct 2013/TPI Coaching/H-1 SIT/Do	Wed Oct 09 06:35:14 PDT 2013	0:11
/Project/PRT FY2014/Common/Monthlies/Oct 2013/TPI Coaching/H-1 SIT/Do	Wed Oct 09 07:20:14 PDT 2013	0:21
/Project/PRT FY2014/Common/Monthlies/Oct 2013/TPI Coaching/CCS/Do	Wed Oct 09 08:00:06 PDT 2013	0:48



Time on Task by Team Member



Planned Time	Count	Avg Actual Time	% of PT
0	1	0.0	
1	0		
2	0		
3	0		
4	2	6.9	173%
5	3	4.0	80%
6	4	5.9	98%
7	2	7.7	110%
8	0		
9	4	10.8	120%
10	1	6.7	67%
12	21	13.5	113%
13	0		
14	0		
15	0		
16	0		
17	0		
18	0		
19	0		
20	0		
21	1	15.2	72%
22	0		



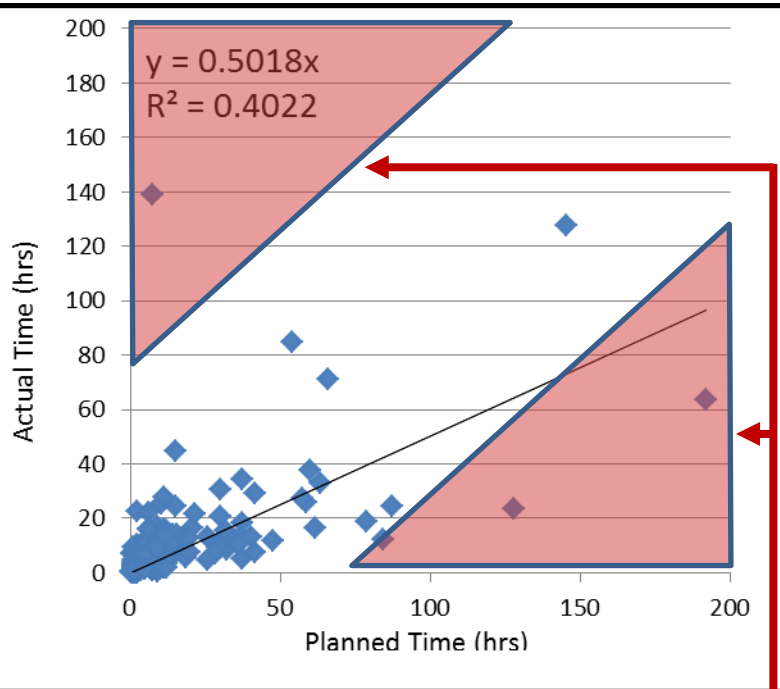
% of entries across all numbers	70%
extra on 5s and 0s	30%

- Time Log analysis
 - Accuracy & precision of estimates
 - Real-time logging vs. backfilling

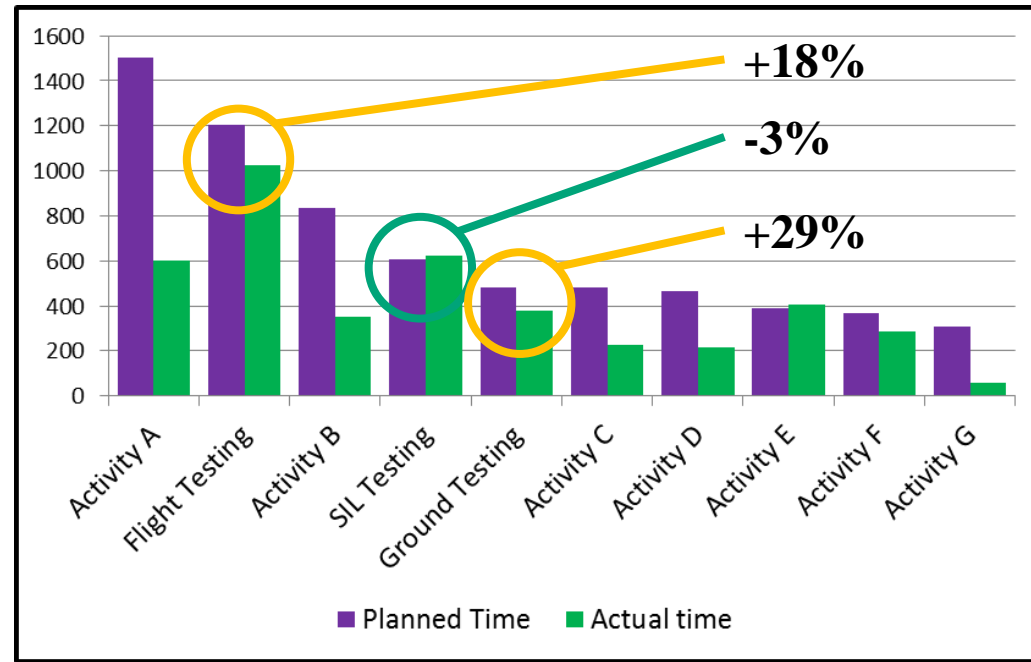


Time by Component

By Component



By Component Type



- Study any points in red regions
- Adjust team productivity rates for next cycle



Time by Workflow

	Plan Time	Actual Time	Plan %	Actual %	Act - Plan	Next Plan	Normalized
Planning	68:06	41:03	2.4%	1.4%	-1.1%	2.4%	2.3%
High-Level Design	248:01	251:46	8.8%	8.4%	-0.4%	8.8%	8.4%
HLD Inspection	103:07	65:44	3.7%	2.2%	-1.5%	3.7%	3.5%
Detailed Design	356:52	339:32	12.7%	11.3%	-1.4%	12.7%	12.2%
Detailed Design Review	129:06	90:59	4.6%	3.0%	-1.6%	4.6%	4.4%
Test Development	61:44	34:58	2.2%	1.2%	-1.0%	2.2%	2.1%
Detailed Design Inspection	294:44	220:51	10.5%	7.4%	-3.1%	7.4%	7.1%
Code	435:48	575:10	15.5%	19.2%	3.7%	19.2%	18.4%
Code Review	143:08	112:39	5.1%	3.8%	-1.3%	5.1%	4.9%
Compile	21:04	16:06	0.7%	0.5%	-0.2%	0.7%	0.7%
Unit Test	349:58	485:12	12.4%	16.2%	3.7%	16.2%	15.5%
Code Inspection	365:50	444:37	13.0%	14.8%	1.8%	13.0%	12.5%
Build and Integration Test	189:47	290:05	6.7%	9.7%	2.9%	6.7%	6.5%
Postmortem	46:48	29:26	1.7%	1.0%	-0.7%	1.7%	1.6%
Total	2814:03	2998:08	100.0%	100.0%		104.3%	100.0%

- Isolate times for one kind of activity
 - Analyze & discuss big differences
 - Proposed planned %s for next cycle



Size-Based Postmortem

- Once the team has consistent size data...
 - Productivity Rates by Team Member
 - Planned vs. Actual Size by Component
- Example of Size Documentation

BASE PROGRAM SIZE	Estimated SIZE	Actual SIZE
BASE SIZE (B)	150	150
DELETED SIZE (D)	75	75
MODIFIED SIZE (M)	8	8

BASE ADDITIONS	Estimated			Actual	
	TYPE	ITEMS	REL. SIZE	SIZE	SIZE ITEMS
Report Altitude				10	13
				Total: 10	13

[add more rows for base additions...](#)

PARTS ADDITIONS	Estimated				Actual			
	TYPE	ITEMS	REL. SIZE	SIZE	NR	SIZE	ITEMS	NR
GUI	I/O	1	Medium	16	<input type="checkbox"/>	22		<input type="checkbox"/>
Altimeter Referencing	Logic	1	Large	23	<input type="checkbox"/>	33		<input type="checkbox"/>
				Total: 39		55		

[add more rows for parts additions...](#)



Productivity Rates by Team Member

- All individuals have their own rates...per product type

PROBE

Method: PROBE Method C3 for Time

Correlate: New & Changed LOC

with: Time

Estimate: % range: 70

L. Regression

Projection = ????

Beta0 = -43.9625

Beta1 = 1.6923

r² = 0.7169

p = 3.35%

Variance = 38413.02

StdDev = 195.992

Range = ????

UPI = ????

LPI = ????

Average

Projection = ????

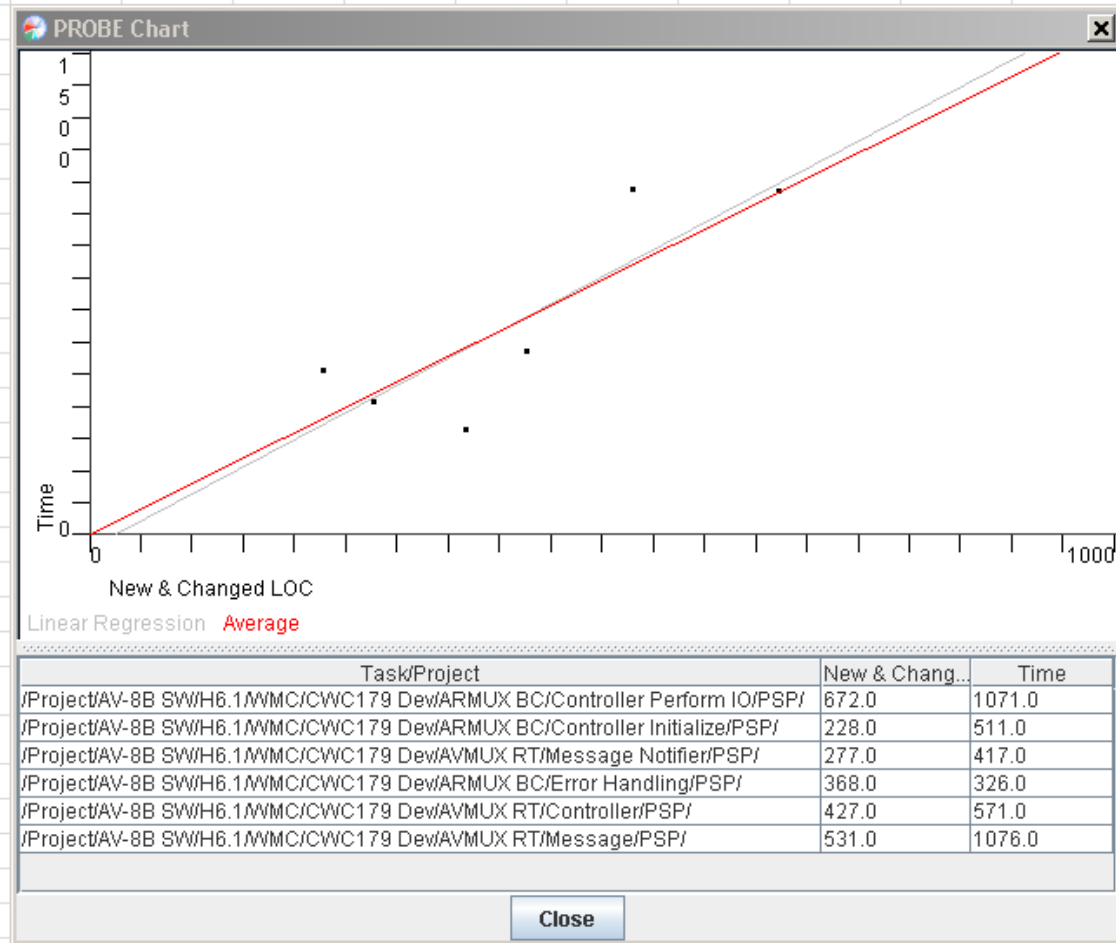
Beta0 = 0.0

Beta1 = 1.5869

Filter...
Chart...
Close

Beta1 (minutes/LOC) = 1.587

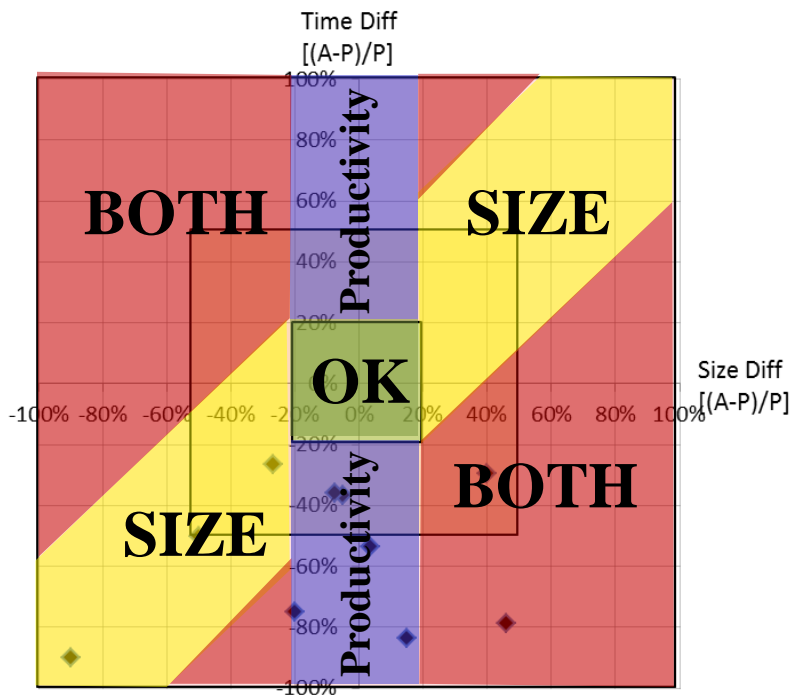
PSP Productivity Rate (LOCs/Hr) = 38



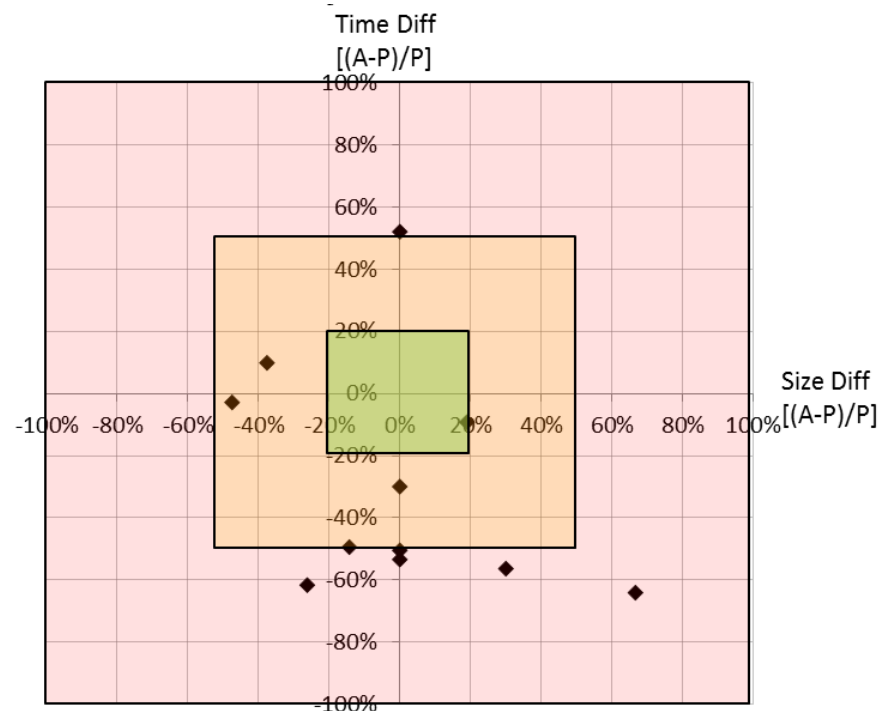


Size by Component

Previous Cycle Components



Current Cycle Components





Quality-Based Postmortem

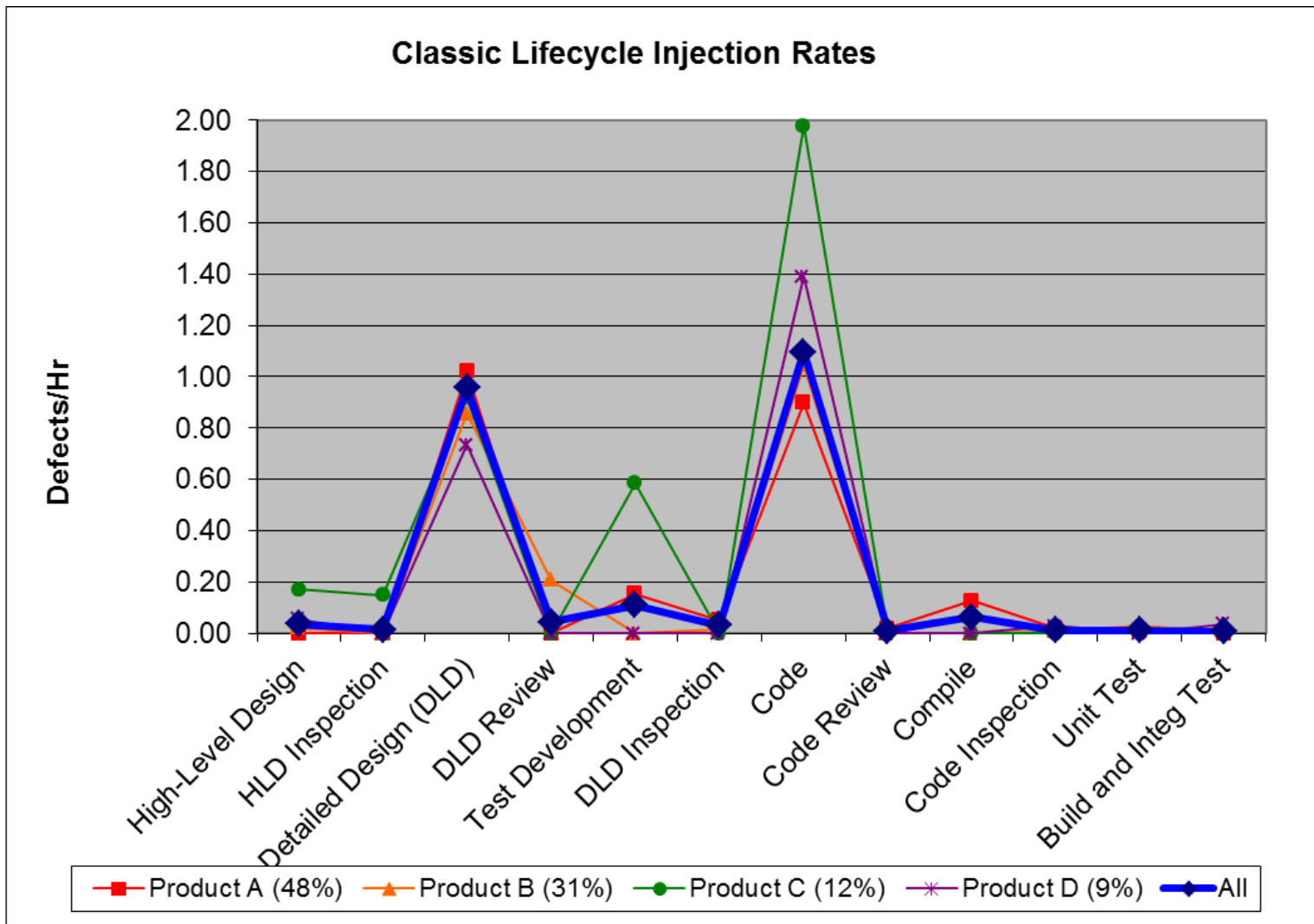
- Getting a handle on defects usually happens last
 - Defect Injection Rate by Phase
 - Defect Measures by Defect Type
 - Defects Injected by Phase
 - Defects Removed by Phase

- Sample Defect Log

Project	ID	Type	Injected	Removed	Time	Count	Description	Date
/Non Project/PSP for Engineers/Program 5	1	Environment	Test	Test	0.6	1			did not configure wires properly during board test	09/03/2009
/Non Project/dev/PMPT/JDAM Cross Range	1	Interface	Design	Design Review	5.3	1			forgot to consider general architecture classes in my ...	08/25/2010
/Non Project/dev/PMPT/JDAM Cross Range	2	Assignment	Design	Design Review	10.8	15			didn't initialize parameters	09/10/2010
/Non Project/dev/PMPT/JDAM Cross Range	3	Documentation	Design	Design Review	5	1			did not draw data flow arrows in correct direction bet...	10/13/2010
/Non Project/dev/PMPT/JDAM Cross Range	4	Interface	Design	Design Review	0.6	1			forgot to flesh out paras for func Compute Angle	11/17/2010
/Non Project/dev/PMPT/JDAM Cross Range	5	Interface	Design	Design Review	1.2	1			forgot to flesh out paras for func Compute Range	11/18/2010
/Non Project/sw history/Prod A Reqt 3	1	Function	Code	Test	1.1	1			inverted to variables	01/28/2009
/Non Project/sw history/Prod A Reqt 3	2	Unclear	Design	Design Review	0.9	3			did not give vars initial values...	10/11/2011



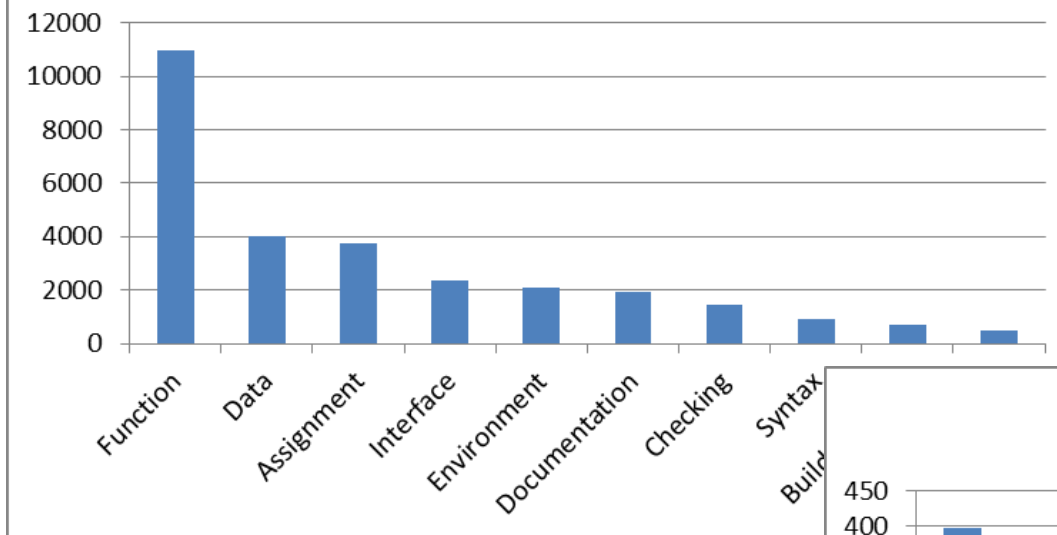
Defect Injection Rate by Phase





Defect Measures by Defect Type

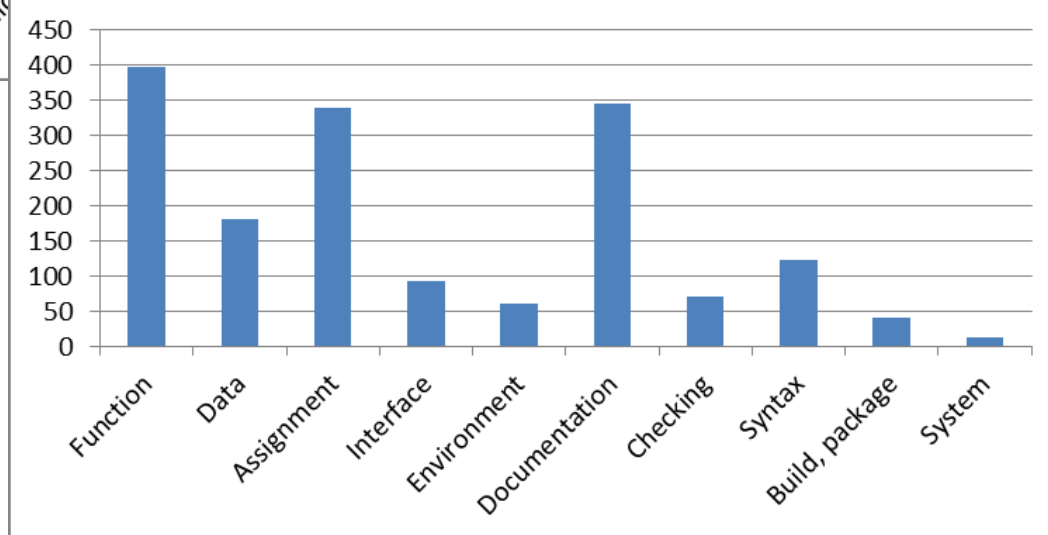
Defect Fix Times



How many doesn't always matter

- Sorted by Fix Time

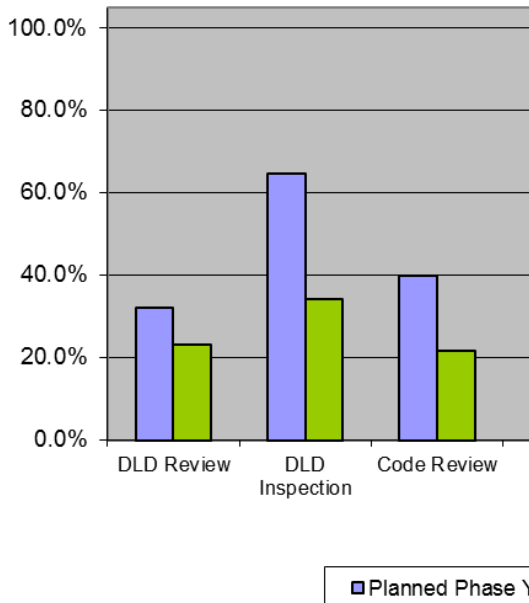
Defect Counts



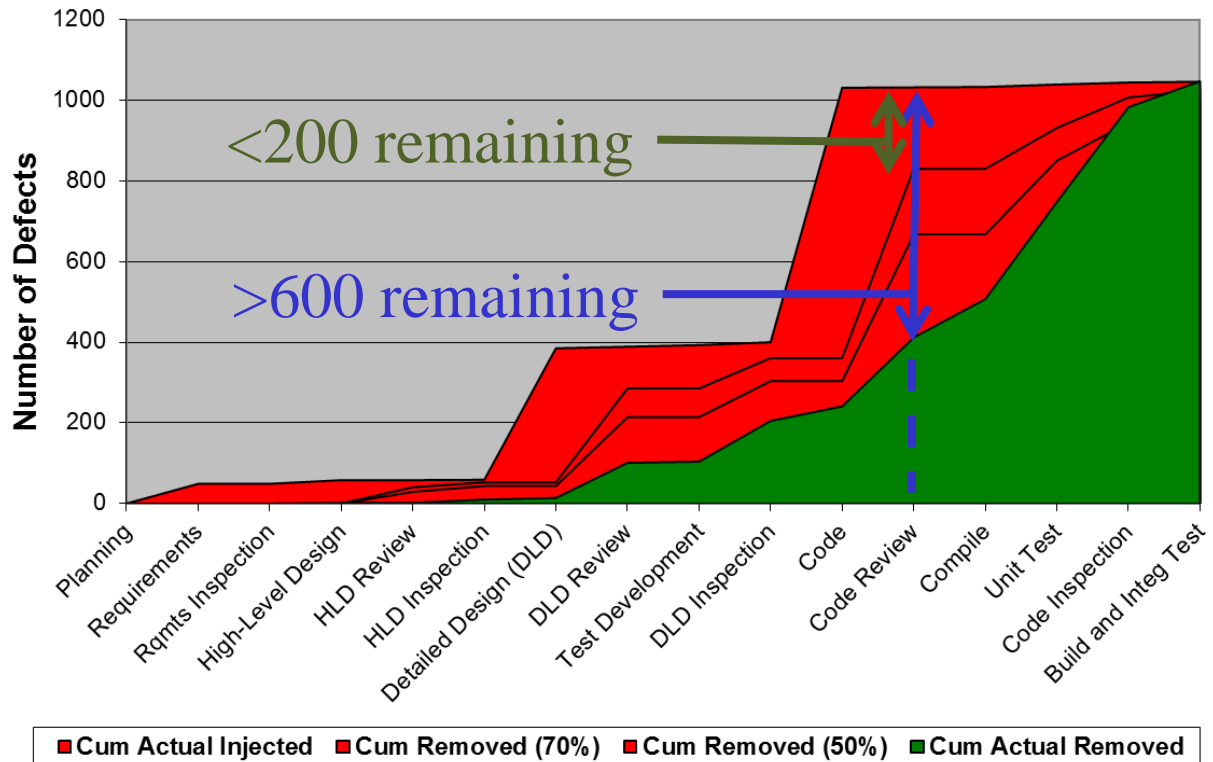


Defects Injected/Removed by Phase

Planned vs. Actual Phase Yields



Cumulative Defects Injected and Removed





TxP Postmortem

- Only after the team knows what level of process performance results in a quality product, then they can set goals and compare planned values to actual values.

RATIOS			
Plan	Actual	Phase	
0.36	0.27	DLD Review/DLD Ratio	
0.82	0.59	DLD/Code ratio	
0.33	0.20	Code Review/Code	
0.00	3.15	Compile Defect Density	
8.86	7.81	Unit Test Defect Density	

REVIEW RATES (LOCs/hr)			
Plan	Actual	Phase	
336	829	DLD review	
71	136	DLD inspection	
147	266	CODE review	
60	62	CODE inspection	

Cost of Quality (COQ)		
Topic	Plan	Actual
% Appraisal COQ	36.8%	30.8%
% Failure COQ	19.9%	26.1%
Appraisal / Failure Ratio (AFR)	1.85	1.18



Things to Remember

- As a team's process evolves from TPI to TxP, the analysis of their data needs to evolve too
- Focus on what is value-added to the team and they will strive to collect the data
- This analysis gives them insight into the quality of their processes used to produce their products and provide their services



Questions?

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 - CMMI[®]
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Acronym List

- A/FR – Appraisal Failure Ratio
- CMM – Capability Maturity Model
- CMMI – Capability Maturity Model Integration
- COQ – Cost of Quality
- DLD – Detailed-Level Design
- EV – Earned Value
- HLD – High-Level Design
- LOC – Line of Code
- NAVAIR - Naval Air Systems Command
- PI – Process Improvement
- PROBE – PROxy-Based Estimating
- PRT – Process Resource Team
- PSP – Personal Software Process
- SEI – Software Engineering Institute
- TSP – Team Software Process
- TPI – Team Process Integration
- TxP – Team [topic name] Process