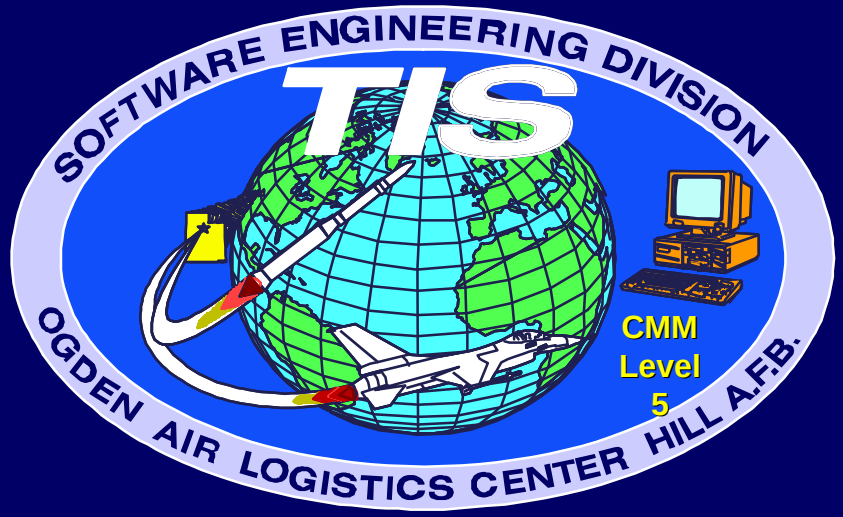

Process Improvement (PI) Benefits & the need to start your measurement program at the start of your PI efforts

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Agenda

- **The importance of beginning your measurement program early and growing it with the process(es).**
- **The benefits we have seen**
- **How our measurement program exists today**

The General's Questions

- How are you doing?
  - How do you know?
- Are you getting better?
  - How do you know?

Lessons Learned

- **A discussion on the benefits we have received would be incomplete if I did not address**
  - > **the problems we have encountered in trying to calculate a ROI**
  - > **some of the assumptions that were made**
  - > **defining ROI**

– **We are not unique, at an Air Force meeting in Fall 98 other USAF representatives reported similar difficulties**

Why are the ROI calculations difficult

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- **At the start of our PI effort**
  - **CMM Level 3 was mandated**
    - > **Calculating a ROI was not planned**
  - **We did not know what our capabilities were**
    - > **Consistent with a CMM Level 1 organization**
  - **We did not try to calculate our capabilities and baseline the information**
- **Assumptions / Estimates are difficult to make and easy to challenge**

Defining ROI or Cost Avoidance

- **ROI = Savings / Investment**
  - **Investment is the easiest to capture**
  - **What constitutes savings?**
    - **For a for profit organization = increased profits**
      - **Reduced costs may not give a 1:1 relation to increased profit**
    - **For a non-profit organization = ?**
      - **We used savings to the customer/taxpayer**

ROI Calculations

- **Tangible savings Vs Intangible savings**
  - **Cost reductions (tangible) are easy to apply to ROI**
  - **Schedule and Quality improvements along with other intangible benefits (e.g. customer satisfaction, morale) are often impossible to quantify in terms of dollar savings**

Examples of data we could retrieve

- **Manpower numbers**
- **Funding (often covered the number of people, e.g. level-of-effort)**
- **Actual high-level schedules (start date and acceptance date)**
- **Number of products delivered**
- **Number of SLOC, functions, etc.**

ROI Data

- **Used**
  - **For our initial costs**
    - **Limited cost data available from OFP**
    - **Estimated cost data using schedules in ATE**
  - **For our present costs**
    - **Actual cost data**
  - **Investments**
    - **ESIP funding**
    - **Estimate of additional overhead funds used ('97-'98)**

ROI calculated on Cost Avoidance to our customer

ROI Data Continued

- **Not used**
  - **Quality data**
    - **e.g. estimating a savings to the customer for less maintenance costs**
  - **Estimates of the overhead funds invested for our first six years (‘91-’96)**

Example of assumptions

- **ATE enhancements funded as a level-of-effort and not on a per-product-delivered basis**
  - **We knew the actual schedule for each product**
  - **Typical was to assign 2 to 4 products per engineer**
  - **Assuming 4 products per engineer than on the average one fourth of each product's schedule was charged in labor hours**
  - **Sanity check => Avg calculated cost per product * Total number of tasks = 60% of the yearly labor**
    - **> allowed for tasks that may not have been recorded**

Cost Avoidance

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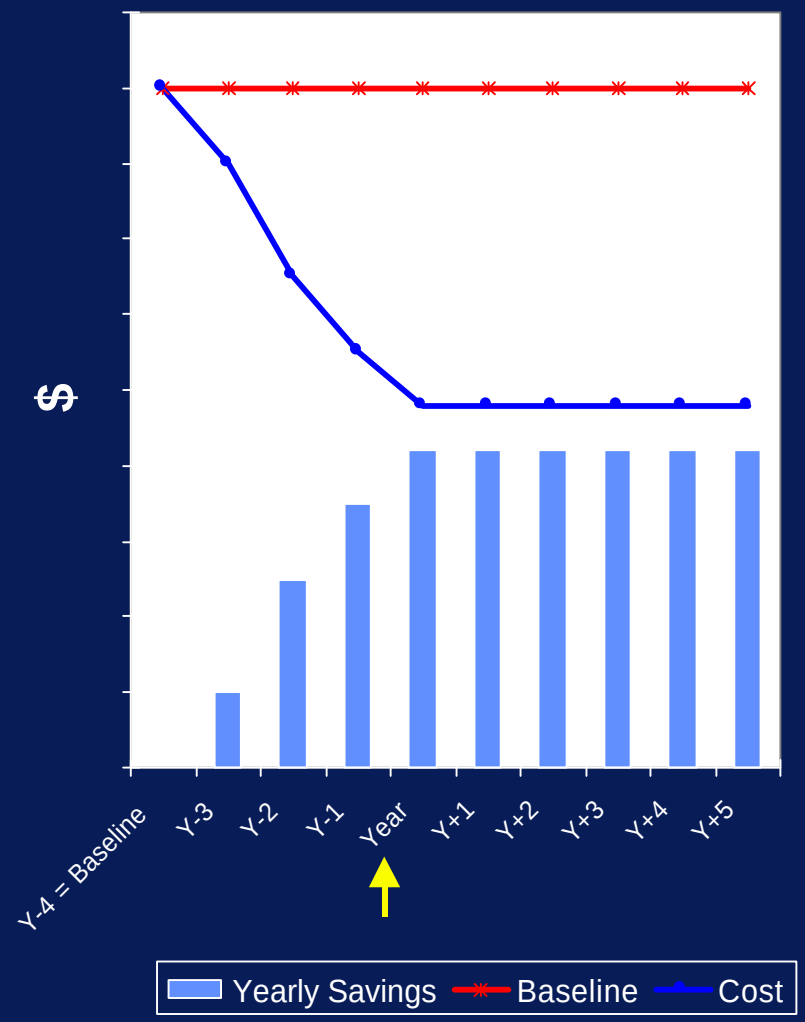

- **Our ROI guidance was to calculate the ROI (Cost Avoidance) on a 10 year moving window**
- **ROI ranged from 4:1 to 19:1 in our various projects**
  - **Our Level-of-effort (LOE) projects gave us the highest ROIs**

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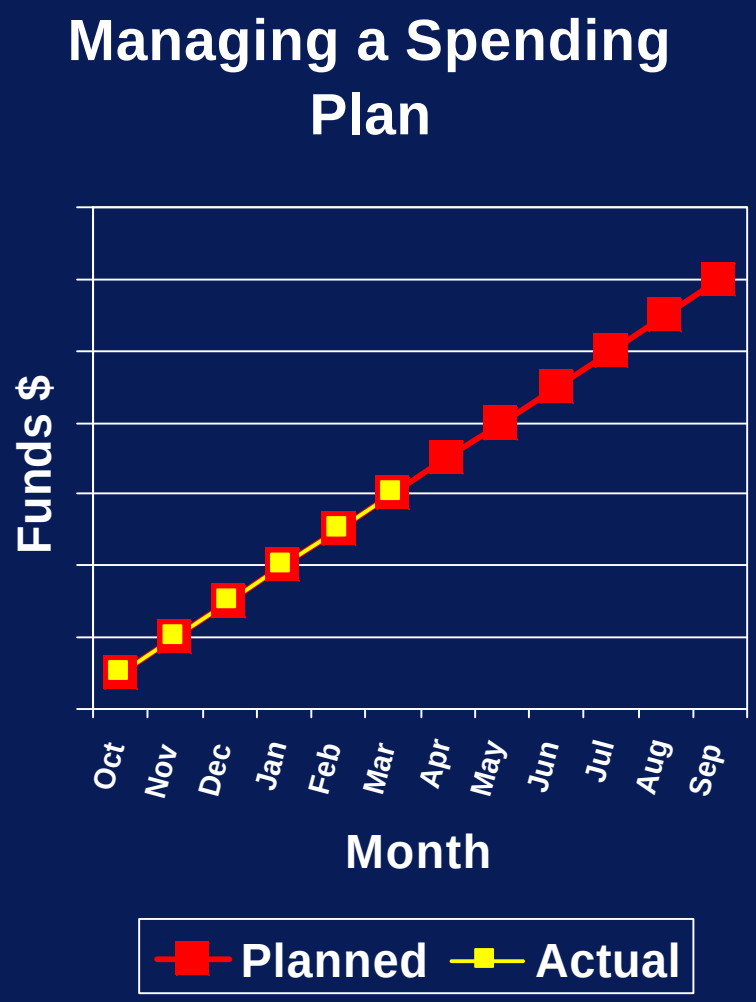
Cost Benefits

- **Quantifiable knowledge of our Process**
  - **Knowledge of cost and schedule to the process block level**
    - **Ability to use SPC concepts at the micro level - Some SPC techniques explored were ineffective at the macro level**
- **Ability to identify where our bottlenecks are in the process**
- **Ability to identify the best ROI activities when addressing process improvements (focusing our efforts)**

Cost Benefits Continued



- **We now have an ability to manage more than a spending plan (a.k.a. burn rate)**
  - **Being 50% through the schedule (in calendar days) and having spent 50% of the funds does not mean that the project is 50% complete**
    - **In the '80s our managers relied on this and the engineer's estimated % complete**

Example of Reduced Cycle Times

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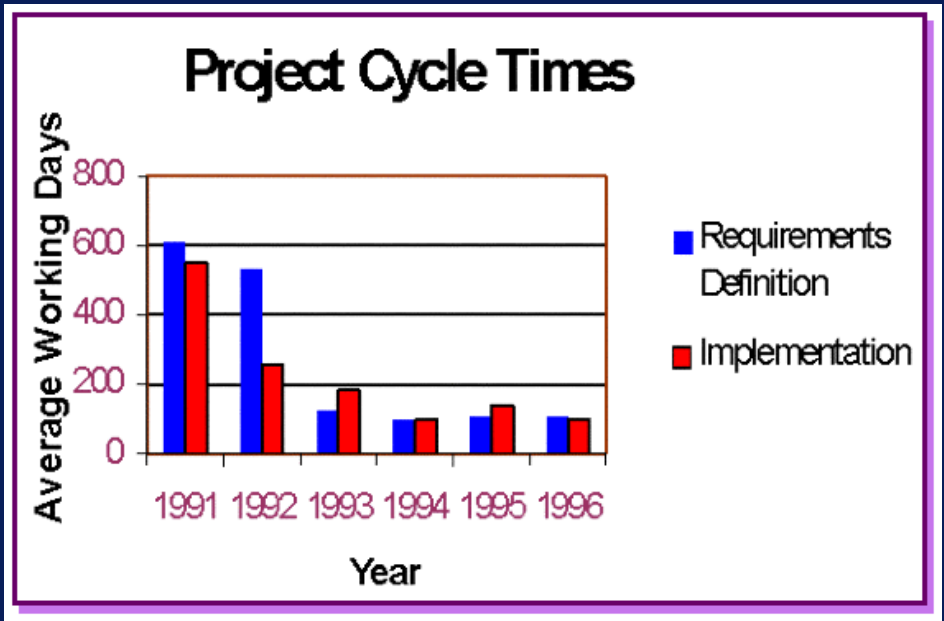

- **Our ATE Level-of-Effort maintenance projects reduced their cycle times by approximately 70%**
- **In 1996 we teamed with other USAF agencies to further reduce the overall response time.**
  - **From over 3 years to a goal of a 100 day average**

Example of Improved Productivity

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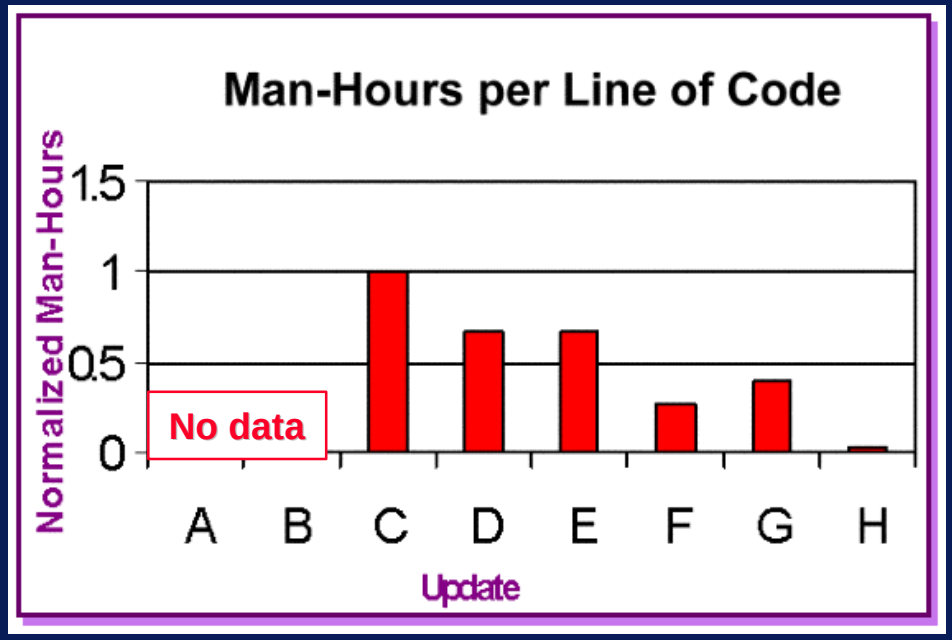

Cost Per SLOC decreased by 34%

- **The drop from projects "G" to "H" has been attributed to**
  - **The ability to reuse software from another project**
  - **Moving to a newer generation of programming language**
  - **Other Process Improvements**

Quality Benefits

- **Quantifiable knowledge of our defects**
  - **Where they are occurring**
  - **How often they occur**
  - **The severity of the defects**
  - **The impact to cost and schedule to remove the defect**
- **Ability to take appropriate action to prevent the defects**

Example of Reduced Defects

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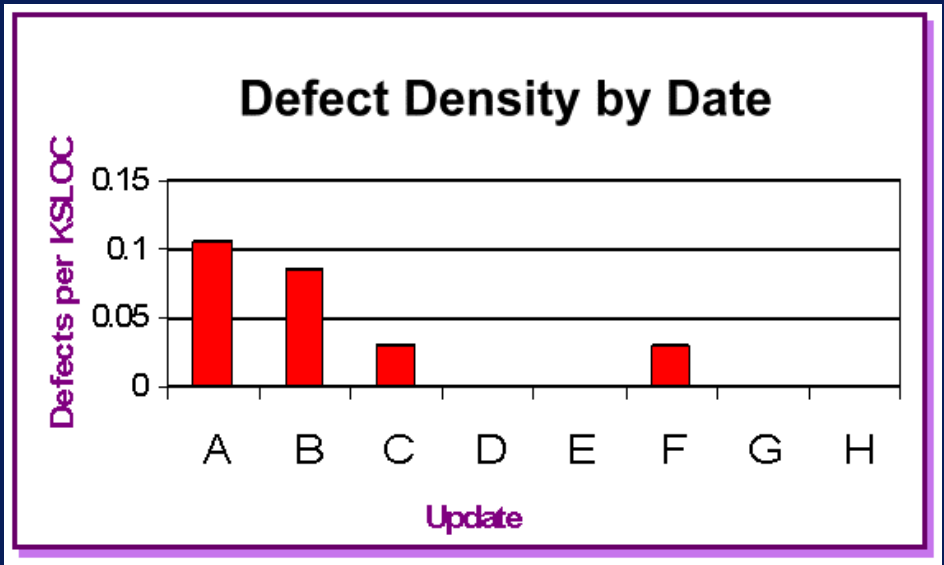

- **Defect Tracking includes**
  - **Those found Internal and External**
  - **Minor, Moderate, Major & "Show Stoppers"**
    - **Major = does not meet requirements**

Testing Costs decreased by 39%

Defects per KSLOC decreased by 42%

Intangible Benefits

- **Better communication with the customer**
  - **Our F-16 ATE customer has on-line access to the status of all projects.**
- **Customer's confidence in our ability**
  - **Program Management Reviews more accurately reflect the status of the project.**
  - **We are better at meeting cost, schedule, and quality requirements.**

Intangible Benefits

- **Improved management involvement and insight into the organization**
- **Management decisions do not rely on assumptions and opinions**
- **Ability to answer the General's questions**
  - **How are you doing?**
    - **How do you know?**
  - **Are you getting better?**
    - **How do you know?**

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Separation of Process & Project Metrics

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- **Project Metrics**
  - **Focus for managing our active projects**
    - > **Where am I at according to my latest plan?**
    - > **How do I get to where I need to go?**
    - > **Calculated on open projects**
- **Process Metrics**
  - **Focus of QPM/SQM meetings**
    - > **How did I do compared to my estimate?**
    - > **How can I improve?**
    - > **Calculated on closed projects (may include closed process blocks)**

Cost & Schedule Metrics

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- **Modified Earned Value concept of Variances**
  - **Earned value did not support process metrics**
  - **Earned value was too sensitive at the start**
  - **Earned value reporting of schedule variance in terms of dollars was not intuitive**
  - **Tracked at the project and process block level**
- **Difficulty is in finding meaningful ways to roll up the information**

Applying CMM to LOE and Non-Engineering Projects

- **Use 4-month and 12-month moving windows of**
  - **Average Cost per product / task in lieu of CV%**
  - **Average Cycle Time per product / task in lieu of SV%**
- **Workload Activity (Monthly snapshot)**
  - **Qty. Received**
  - **Qty. Closed**
  - **Qty. Open (ability to identify Qty. per person)**
  - **Qty in Work Stoppage**
  - **Displayed for a 12-month period**

Defect Metrics

- **Defect Detection Ratio = Percentage of defects found up to each check point divided by all defects found**
- **Defect Density = What the customer sees = No. of released defects / Actual Hours**
- **Defect Injection Rate = No.of defects / Actual Hours**

Applied at both the project and process block levels

Defect Example

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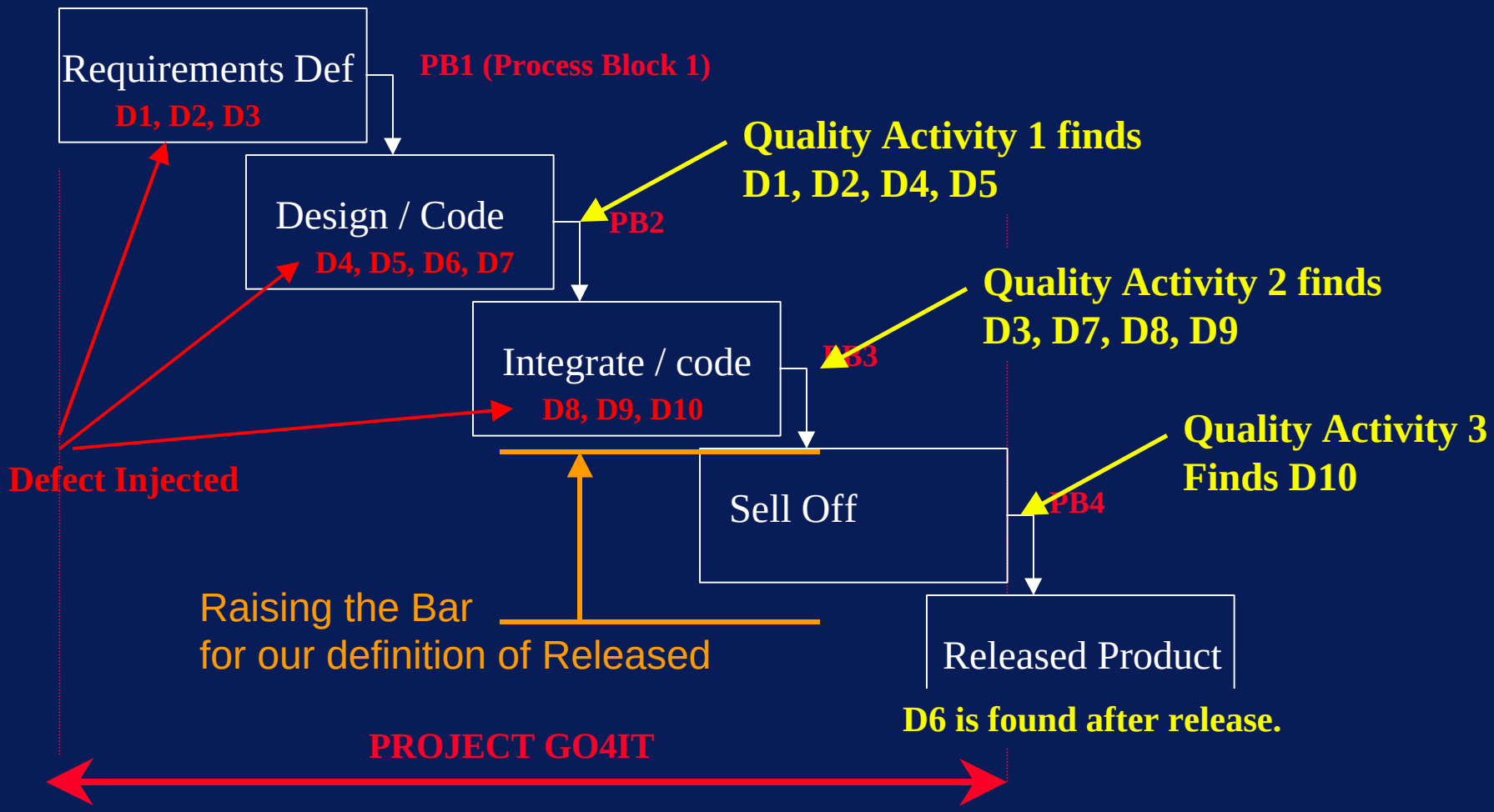
Tracking where defects are Injected and Detected/Removed



Questions?

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