Some Numbers

Chris Cole
Lynn A Becker
Senova Training
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Predictions are hard, especially about the future.

Yogi Berra

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Performance Diagnostic Tool

- *Organizational*
- *Departmental*
- *Team*
- *Individual*

Identify discrepancy

Ensure task with discrepancy is essential to business objective

Ensure discrepancy has a significant negative impact

External to performer(s)

Performer (s) = People

Internal to performer(s)

Environmental (Intangibles)

Resources (Tangibles)

1. Organizational Environment
   - marketing strategy
   - products/services
   - problems/threats to organization
   - business opportunities

2. Organizational Systems
   - clear & unambiguous objectives
   - meaningful & achievable standards
   - metrics captured and available
   - procedures that are accurate, available, up-to-date.

3. Incentives
   - Rewards: pay, bonuses, recognition
   - Feedback frequent, specific,
   - Consequences understood.
   - Desired behavior not punishing

4. Cognitive Support
   - job aids
   - documentation
   - electronic performance support
   - user interface design

5. Hardware Tools
   - computers
   - software
   - VCR's
   - calculators
   - automobiles

6. Physical Environment
   - noise
   - light
   - temperature
   - physical layout

7. Knowledge / Skills
   - training
   - education
   - experience

8. Inherent Ability
   - intelligence
   - emotional ability
   - physical attributes
   - education
   - artistic gifts
   - internal motivation

Check and fix this end first

Standish Group Survey

- 31% of all software projects are canceled before completed ($81 billion waste)
- 53% of projects will cost 189% of estimates
- 9% on time and on budget (large companies)
- 16% on time and on budget (small companies)

Calculating Your Return on Investment from More Effective Requirements Management, Dean Leffingwell, Rational Software, Inc.
http://www.rational.com/sitewide/support/whitepapers/dynamic.jtmpl?doc_key=300

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Standish Group Survey

Project Impairment Factors	Percent of Responses
Lack of User Input	12.8%
Incomplete Requirements and Specifications	12.3%
Changing Requirements and Specifications	11.8%

Calculating Your Return on Investment from More Effective Requirements Management, Dean Leffingwell, Rational Software, Inc.
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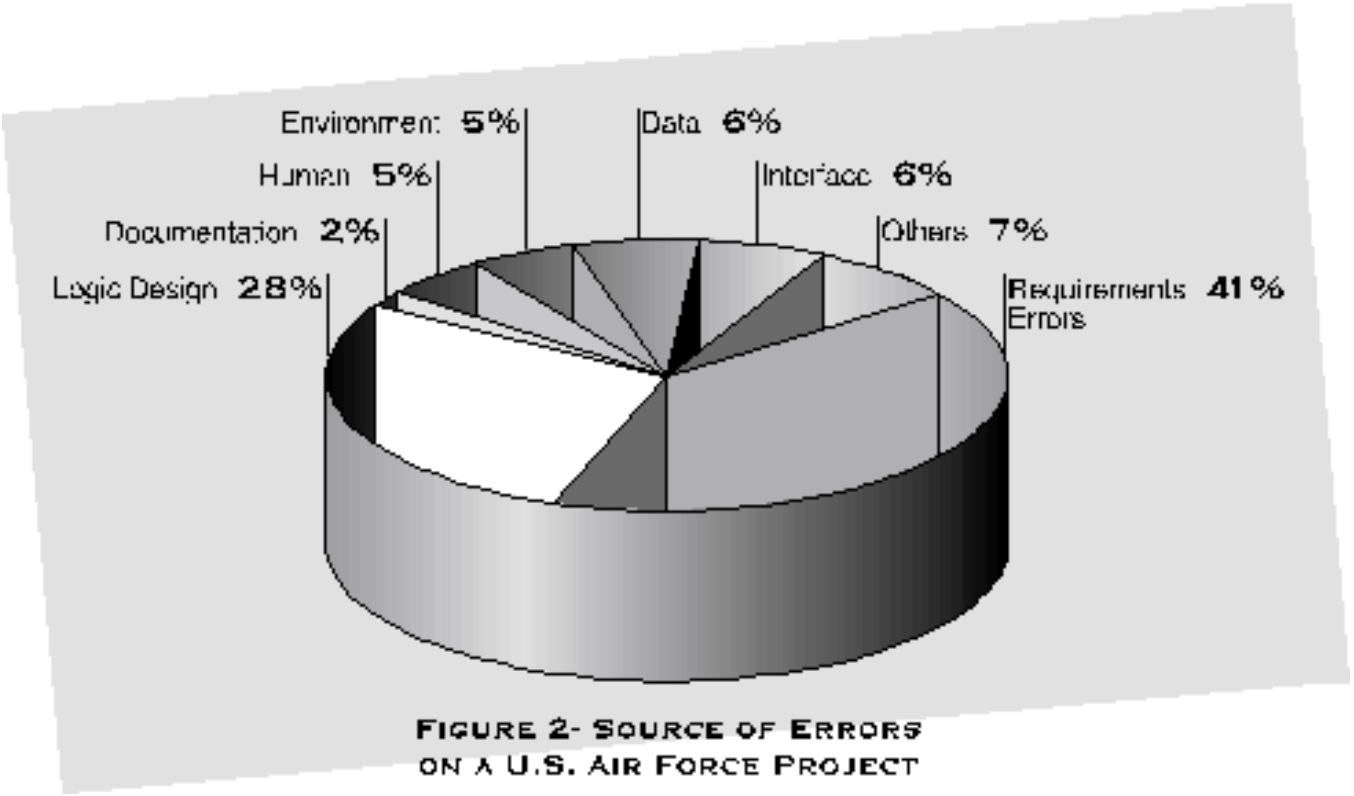

FIGURE 2- SOURCE OF ERRORS ON A U.S. AIR FORCE PROJECT

“Studies have shown that neglecting to carefully elicit project requirements and poor management of those requirements are the most significant reasons that 40% of all software projects fail.”

CHAOS ‘97, The Standish Group International Inc.

Sheldon, F. et al, "Reliability Measurement from Theory to Practice", *IEEE Software, July 1992*

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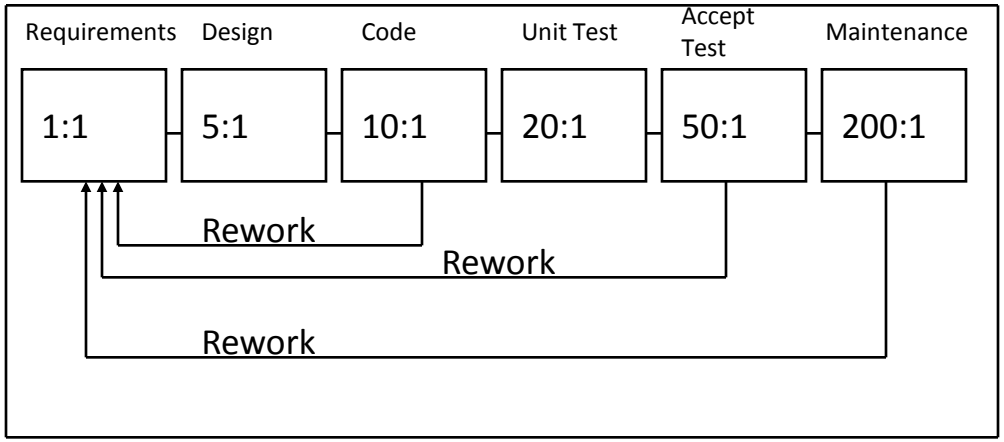
Relative Cost of Re-work



- To detect/repair a defect in the Requirements phase incurs 1 unit of cost
- To detect/repair a defect in Code incurs 10 times the cost of detecting/repairing that same defect in Requirements
- To detect/repair a defect in Acceptance Test incurs 50 times the cost of detecting/repairing that same defect in Requirements
- A 200:1 cost savings is achieved by finding defects in Requirements versus Maintenance

Rockwell Collins
Calculating Your Return on Investment from More Effective Requirements Management, Dean Leffingwell, Rational Software, Inc. (http://www.rational.com/sitewide/support/whitepapers/dynamic.jtmpl?doc_key=300)
Software Engineering Economics, Barry Boehm, p. 40.

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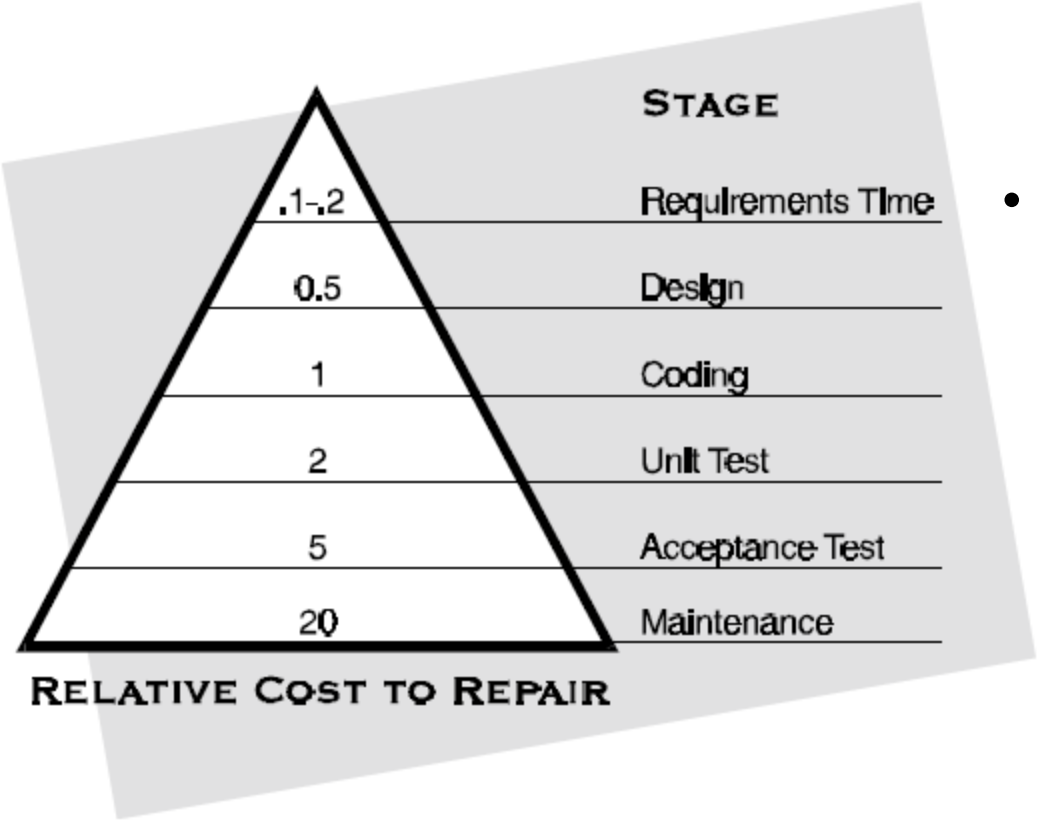
GTE/TRW/IBM



- Studies measured and assigned costs to errors occurring at various phases of the project
- If a unit cost of *one is assigned to* the effort required to detect and repair an error during the coding stage, then the cost to detect and repair an error during the requirements stage is between *five to ten times less. Furthermore, the cost to detect* and repair an error during the maintenance stage is *twenty times more.*

Davis, A., "Software Requirements - Objects, Functions and States", Prentice Hall, 1993

Rework Costs

- In a study performed at Raytheon, Dion reported that approximately 40% of the total project budget was spent in rework costs .
- Boehm reports that the cost of rework can approach 50% for the largest software projects. Because of their large number, and the multiplying effect, *finding and fixing requirement errors consumes between 70% - 85% of total project rework costs.*

Dion, R. “Process Improvement and the Corporate Balance Sheet,” *IEEE Software, (July 1993),pp. 28-35*

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Example Quality Costs

Prevention	*Appraisal*
• Staff training • Requirements analysis • Early prototyping • Fault-tolerant design • Defensive programming • Usability analysis • Clear specification • Accurate internal documentation • Evaluation of the reliability of development tools (before buying them) or of other potential components of the product	• Design review • Code inspection • Glass box testing • Black box testing • Training testers • Beta testing • Test automation • Usability testing • Pre-release out-of-box testing by customer service staff
Internal Failure	***External Failure***
•Bug fixes •Regression testing •Wasted in-house user time •Wasted tester time •Wasted writer time •Wasted marketer time •Wasted advertisements •Direct cost of late shipment •Opportunity cost of late shipment	•Technical support calls[9] •Preparation of support answer books •Investigation of customer complaints •Refunds and recalls •Coding / testing of interim bug fix releases •Shipping of updated product •Added expense of supporting multiple versions of the product in the field •PR work to soften drafts of harsh reviews •Lost sales •Lost customer goodwill •Discounts to resellers to encourage them to keep selling the product •Warranty costs •Liability costs •Government investigations •Penalties •All other costs imposed by law

Quality Cost Analysis: Benefits and Risks by Cem Kaner, January 1996

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True Impact

Seller: external failure costs	*Customer: failure costs*
•Technical support calls •Preparation of support answer books •Investigation of customer complaints •Refunds and recalls •Coding / testing of interim bug fix releases •Shipping of updated product •Added expense of supporting multiple versions of the product in the field •PR work to soften drafts of harsh reviews •Lost sales •Lost customer goodwill •Discounts to resellers to encourage them to keep selling the product •Warranty costs •Liability costs •Government investigations •Penalties •All other costs imposed by law	•Wasted time •Lost data •Lost business •Embarrassment •Frustrated employees quit •Demos or presentations to potential customers fail because of the software •Failure when attempting other tasks that can only be done once •Cost of replacing product •Cost of reconfiguring the system •Cost of recovery software •Cost of tech support •Injury / death

Quality Cost Analysis: Benefits and Risks by Cem Kaner, January 1996

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The Project

- 40 hrs design work per lesson
- 20 hrs of development per lesson
- 12 minute lessons
- Animation in only one topic (Description)—the backbone of the lesson
- Developed a number of tools to standardize development efforts
  - Lesson Guidelines
  - Storyboard template with boilerplate

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The Staff

- FT Staff
  - 2 person video crew (Dir of Photography & Producer)
  - 2 VO people
  - 4 IDs
  - 4 SMEs
  - PM
- PT Staff
  - 5-6 developers
  - 1 pt transcription/administrative
  - 1 external Captivate developer

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The Courseware

- Online, level 2 of LOI
- Standardized lesson architecture
  - Introduction (high-definition video shot on soundstage at Screen Gems with crew from One Tree Hill)
  - Description
  - Examples
  - When& Why
  - Show Me How
  - Expert Advice
  - Activities
  - Bottom Line

  - Glossary
  - Resources

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The Process

- Kick-off meeting
- SB1 Development
- Review
- SB2 Development
- Review
- Online Development
- Review
- Revision
- Final Approval Review

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Example of a Spiral

- Review cycle spun out of control quickly
  - 2 review cycles became 5 cycles because of additional stakeholder involvement (Legal, Compliance etc)
  - SME > MGR to SME > MGR > SR MGR > Compl > Marketing > Others

- SB1 – SME
- SB2 – SME > MGR
- OL1 – SME > MGR
- OL2 – SME > MGR
- OL3 – Senior Manager (who sent it out to other internal groups)
- OL4 – Compliance
- OL5 – Marketing

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Consequences

- T101 went for 3 months
- Continued iterations
- Difficult to quantify but probably added at least 20 hrs to development time as well (for each of 9 lessons) [40-50 hours]

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Stats

Tasks	Design Stage (labor hours)	Development Stage (labor hours)
Review lesson storyboards and modify text	.25	.25
Production:		
Modify on-screen text		2
Modify graphics & animations		2
Repackage Voice-Over (VO) scripts and send to VO talent		2
Adjust VO clip sounds to fit in with existing VO		2
Insert new VO clips and adjust timing		3
Review all changes		4
Totals	**0.25**	**15.25**

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61:1

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Scope Creep

Change	Additional Labor Hours (for 25 lessons)
Modify interface, including menu structure, additional buttons, color schemes, etc.	80
Prototyping lesson-to-lesson navigation	32
Add CC text for 80% of course content.	280
Create additional animations	430
Add VO to 111 interactive tutorials (Captivate)	260
Design changes during the development phase	90
Graphic changes from updates to client's web site and trading tools	40

Learning Curve

- In both T101 and O101, our initial development time (first draft of on-line lessons) was fairly standard at around 40 hours per lesson. In both projects, revisions were the major culprit in driving up development time.
- T101 = the extra review cycles and resulting downstream changes drove up dev time from 40 hours on the initial development per lesson to an additional 104 hours per lesson on revisions.
- O101 was nearly the same as for T101 which was a surprise
  - Primary SME for Reviews was not involved in the kickoff or in the initial design so we did go back and make a lot of revisions based on Tim's input that would have been built in from the start if he had been involved at the start
  - There were many changes to O360 that were rolled out while we were developing the lessons and we had to go back and rework content based on those changes.
  - Finally, we spent a lot of development time working through the feedback coming in as it was often very general and non-topic-specific.
  - So for O101, end result was 40 hours on initial development per lesson and 103 hours per lesson on revisions.

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Better Learning Curve

- In BC, SME was involved right from the start which paid big dividends
  - The initial development time was still about the same but the revisions dropped off dramatically.
  - We estimate that we spent approximately 40 hours on initial development per lesson and 40 hours per lesson on revisions.
- In BDS, we had the same team throughout the entire course lifecycle and feedback was detailed and specific.
  - We estimate that we spent approximately 40 hours on initial development per lesson and 34 hours per lesson on revisions.

More Lessons Learned

- Use a formal change process with right person signing off on their side regardless of the size of the project
- Brief and re-brief the problem with scope creep – during kickoff, requirements capture and review meetings
- Quantify the problems if you can and use them in re-brief if possible but do make sure to use in future estimates

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And Some More

- MAP - accountability == “doesn’t matter what it costs, we have to do it” but later on….
- Build into documentation
- Have a well-defined process with customer understanding
- Manage the customer