Software Division

The Global Voice of Quality™

The Power of Peer Review
Session A-1

Presented by
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Slide graphics designed by Phyllis Lee

Note: PDF version shows slide notes in layers view.

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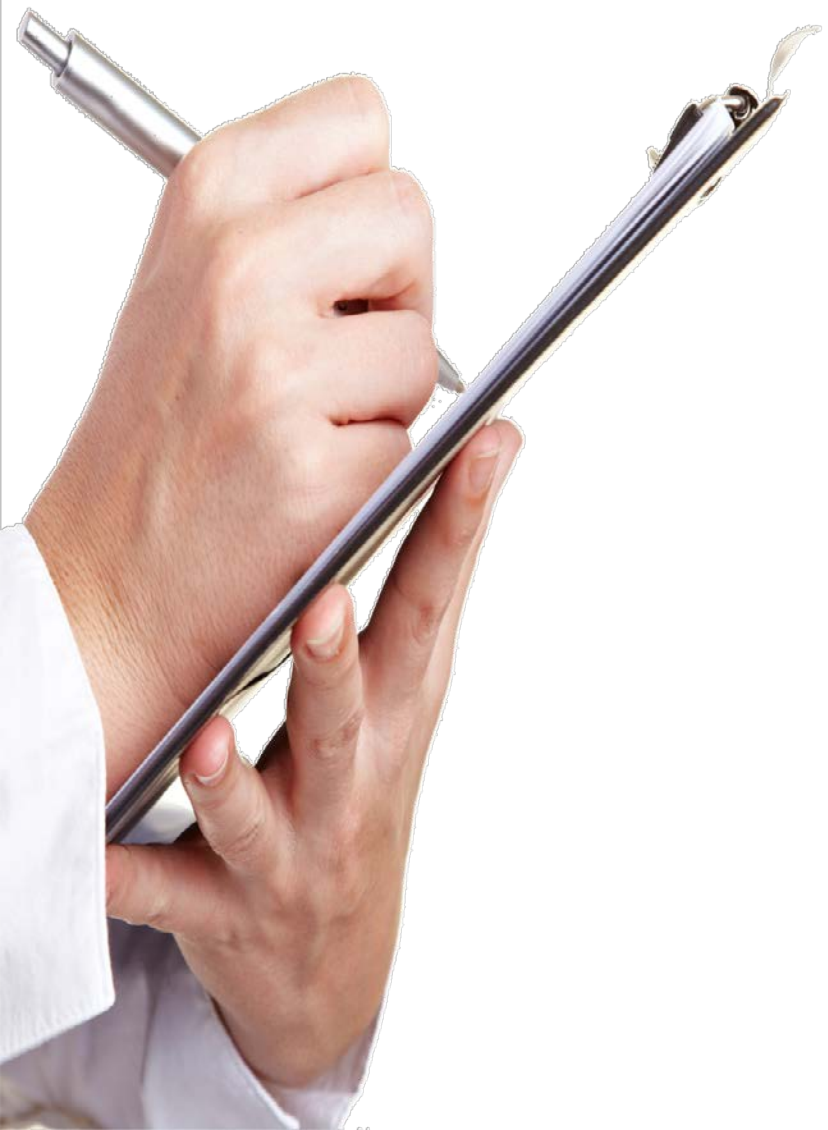

Agenda

- Introductions and Comments
- Defining Peer Review
- Past NASA Failure
- Principles of Peer Review
- Preparation for Peer Reviews
- Practice of Peer Reviews
- Power of Peer Review
- Personal Resources for Peer Review

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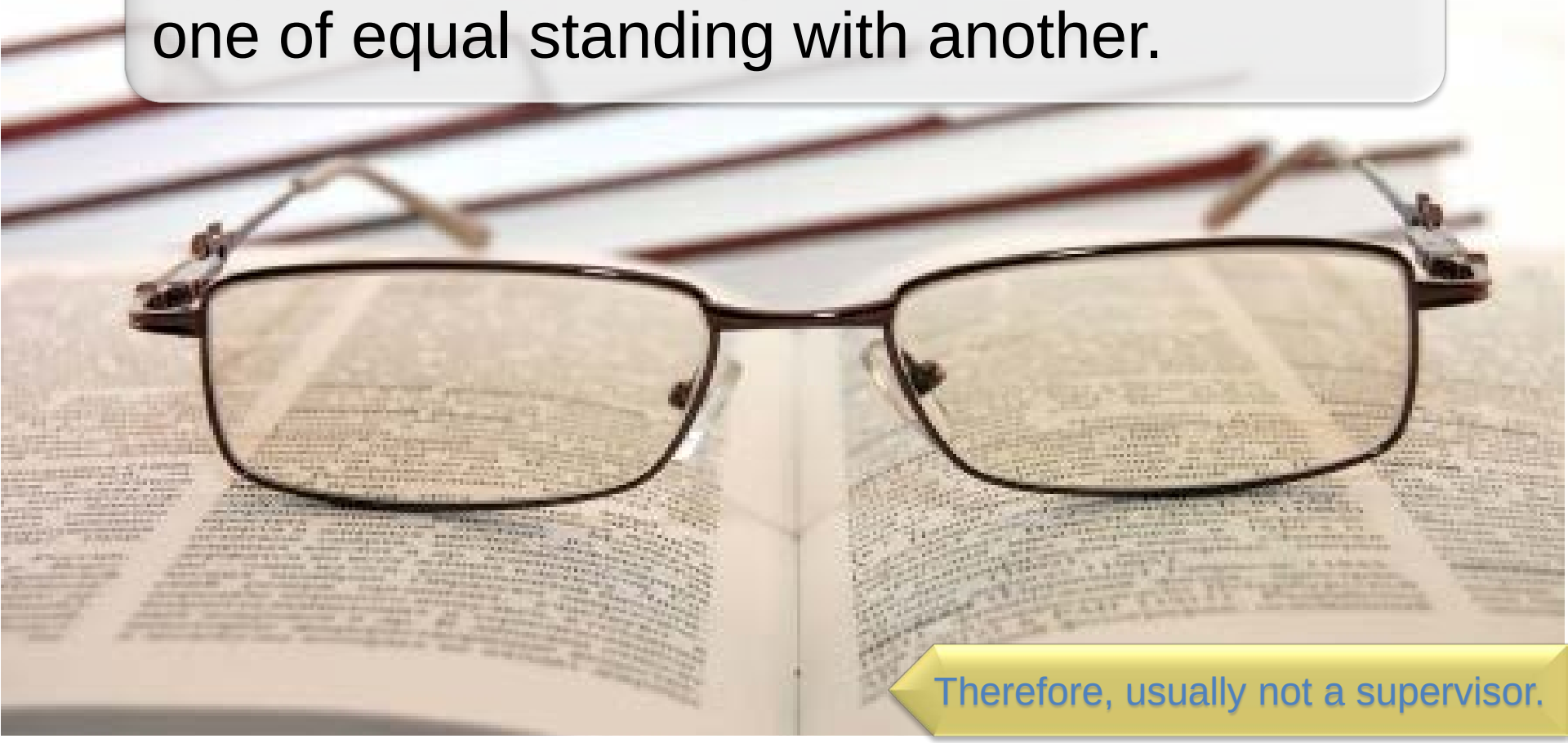
Defining a Peer

A “peer” is defined by Merriam Webster as one of equal standing with another.



Therefore, usually not a supervisor.

Descriptions of Peer Review

By having at least one other set of eyes "peer" review and comment on our work products, at succeeding stages of the Software Development Lifecycle (SDLC), the quality of the work products and deliverables will be improved substantially, delivered earlier, and at reduced cost.

Karl Wiegers, *Peer Reviews in Software-A Practical Guide*, 2003
"An examination of a software work product by people other than its author in order to identify defects (which are departures from specifications or from standards) and improvement opportunities."

CMMI for Development, V 1.3, Appendix D: Glossary "The review of work products performed by peers during the development of work products to identify defects for removal. The term *"peer review"* is used in the CMMI Product Suite instead of the term *'work product inspection.' "*

Peer Review in the CMMI*

Verification PA - Specific Goal 2: "Perform Peer Reviews"

- SP 2.1 Prepare for Peer Reviews
  "Preparation activities for peer reviews typically include identifying the staff to be invited to participate in the peer review of each work product; identifying key reviewers who should participate in the peer review; preparing and updating materials to be used during peer reviews, such as checklists, review criteria and scheduling peer reviews."
- SP 2.2 Conduct Peer Reviews
  "One of the purposes of conducting a peer review is to find and remove defects early. Peer reviews are performed incrementally as work products are being developed. These reviews are structured and are not management reviews."
- SP 2.3 Analyze Peer Review Data
  "Typical data are product name, product size, composition of the peer review team, type of peer review, preparation time per reviewer, length of the review meeting, number of defects found, type and origin of defect, and so on. Additional information on the work product being peer reviewed can be collected, such as size, development stage, operating modes examined, and requirements being evaluated."

***From**: CMMI for Development V 1.3 Verification Process Area

CMMI, CMM, CERT, CMM Integration, Carnegie Mellon, and Capability Maturity Model are registered in the U.S. Patent and Trademark Office.

Participation In Peer Reviews

- How many of you have participated in a structured peer review process in some way?
- How many others have participated in some kind of requested review of a work product, other than testing?
- What have been some of your encouraging experiences in peer review?
- What have been some discouraging experiences with reviews?
- What things have held your project back from implementing Peer Reviews?

Part 1

A Past Failure at NASA

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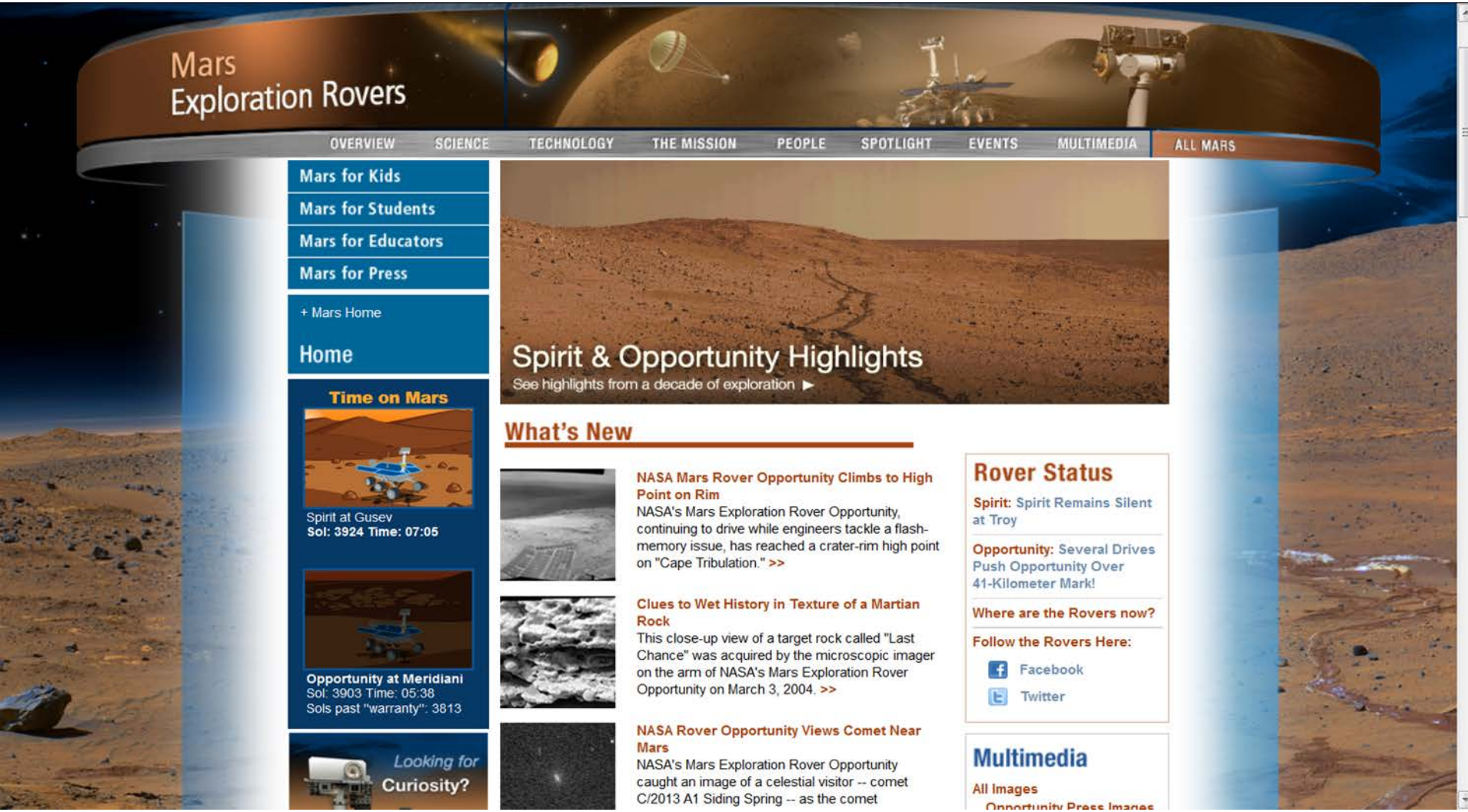
Present NASA Success Not Always the Case



From: http://mars.nasa.gov/mer/home/index.html Courtesy NASA/JPL-Caltech.

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Douglas Isbell
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RELEASE 99-113

MARS CLIMATE ORBITER TEAM FINDS LIKELY CAUSE OF LOSS

A failure to recognize and correct an error in a transfer of information between the Mars Climate Orbiter spacecraft team in Colorado and the mission navigation team in California led to the loss of the spacecraft last week, preliminary findings by NASA's Jet Propulsion Laboratory internal peer review indicate.

"People sometimes make errors," said Dr. Edward Weiler, NASA's Associate Administrator for Space Science. "The problem here was not the error, it was the failure of NASA's systems engineering, and the checks and balances in our processes to detect the error. That's why we lost the spacecraft."

The peer review preliminary findings indicate that one team used English units (e.g., inches, feet and pounds) while the other used metric units for a key spacecraft operation. This information was critical to the maneuvers required to place the spacecraft in the proper Mars orbit.

"Our inability to recognize and correct this simple error has had major implications," said Dr. Edward Stone, director of the Jet Propulsion Laboratory. "We have underway a thorough investigation to understand this issue."

Two separate review committees have already been formed to investigate the loss of Mars Climate Orbiter: an internal JPL peer group and a special review board of JPL and outside experts. An independent NASA failure review board will be formed shortly.

"Our clear short-term goal is to maximize the likelihood of a successful landing of the Mars Polar Lander on December 3," said Weiler. "The lessons from these reviews will be applied across the board in the future."

Reference: http://mars.jpl.nasa.gov/msp98/news/mco990924.html

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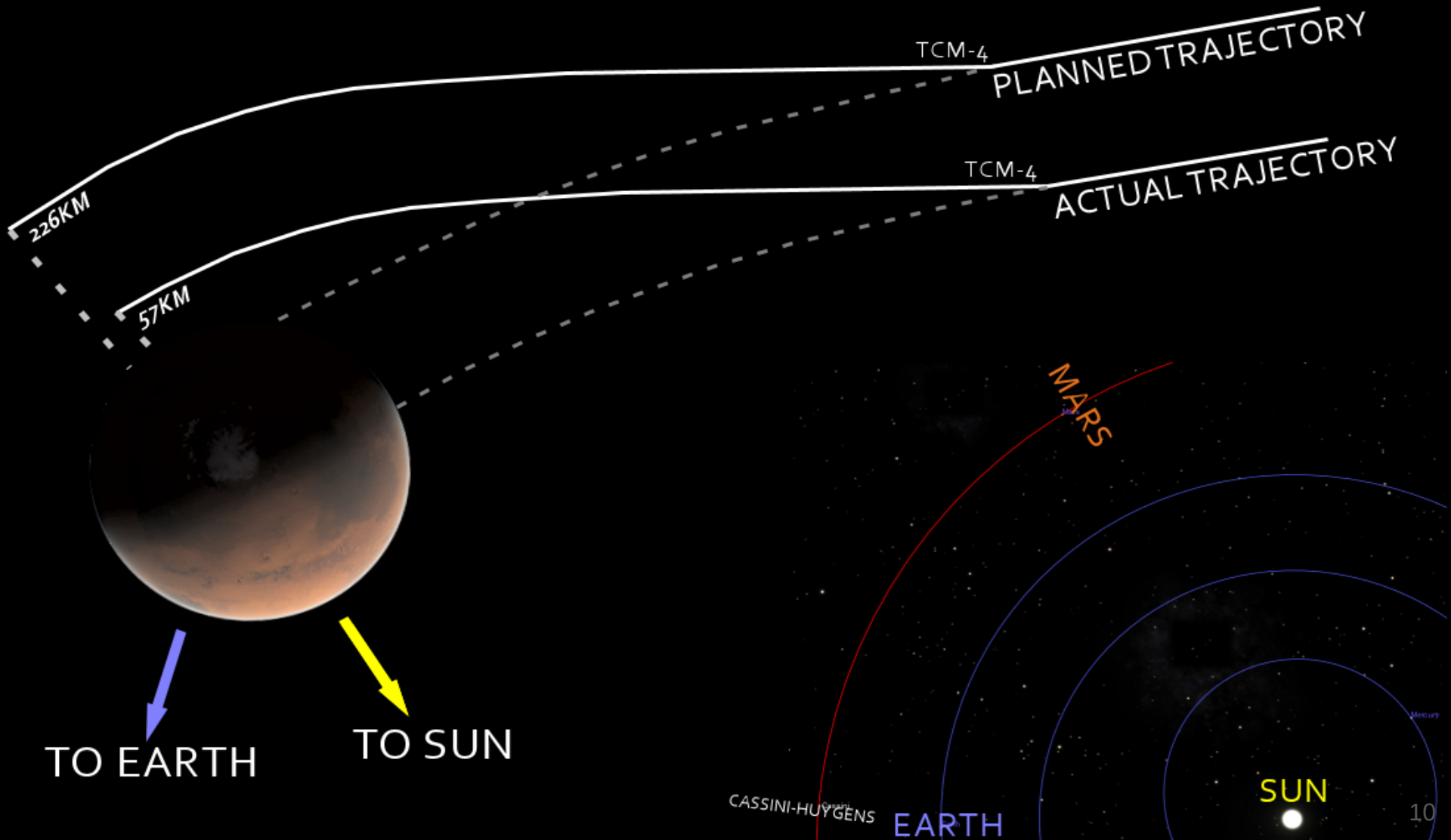
Courtesy NASA/JPL-Caltech.



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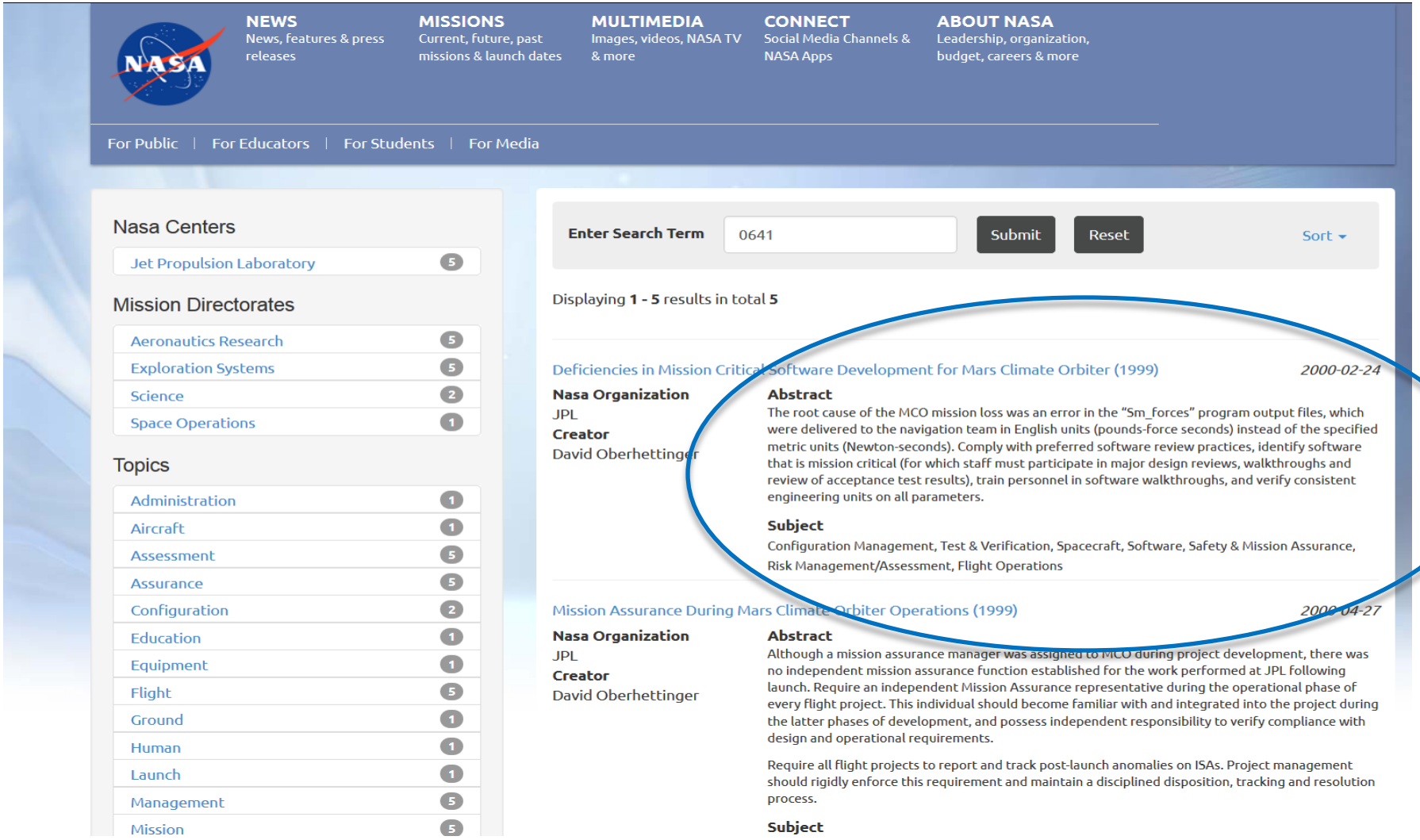
NASA Lessons Learned



Reference: http://llis.nasa.gov/search?q=0641

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Possible NASA Excuses

We are the best in business!

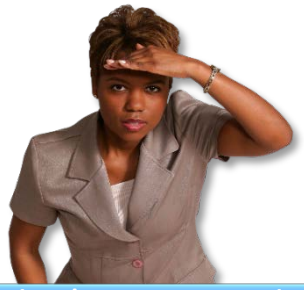
Peer review takes too much time!

I can find my own errors!

The reviewer doesn't understand my code!

What does he/she know?!

We don't need to invite them!



I don't want people looking over my shoulders!

We already reviewed the requirements.

The testers will find all the errors!

We know what we are doing!

Part 2

Principles of Peer Review

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Keys Principles of Peer Review

- Have Peers, Not Customers, Find Errors
- Contain Defects Early in the SDLC
- Train The Entire Team on the Process
- Identify A Peer Review Champion
- Review At Every Stage of the Lifecycle
- Address Cultural Biases, Misunderstandings
- Use Both Informal and Formal Reviews
- Gain Senior Management Support

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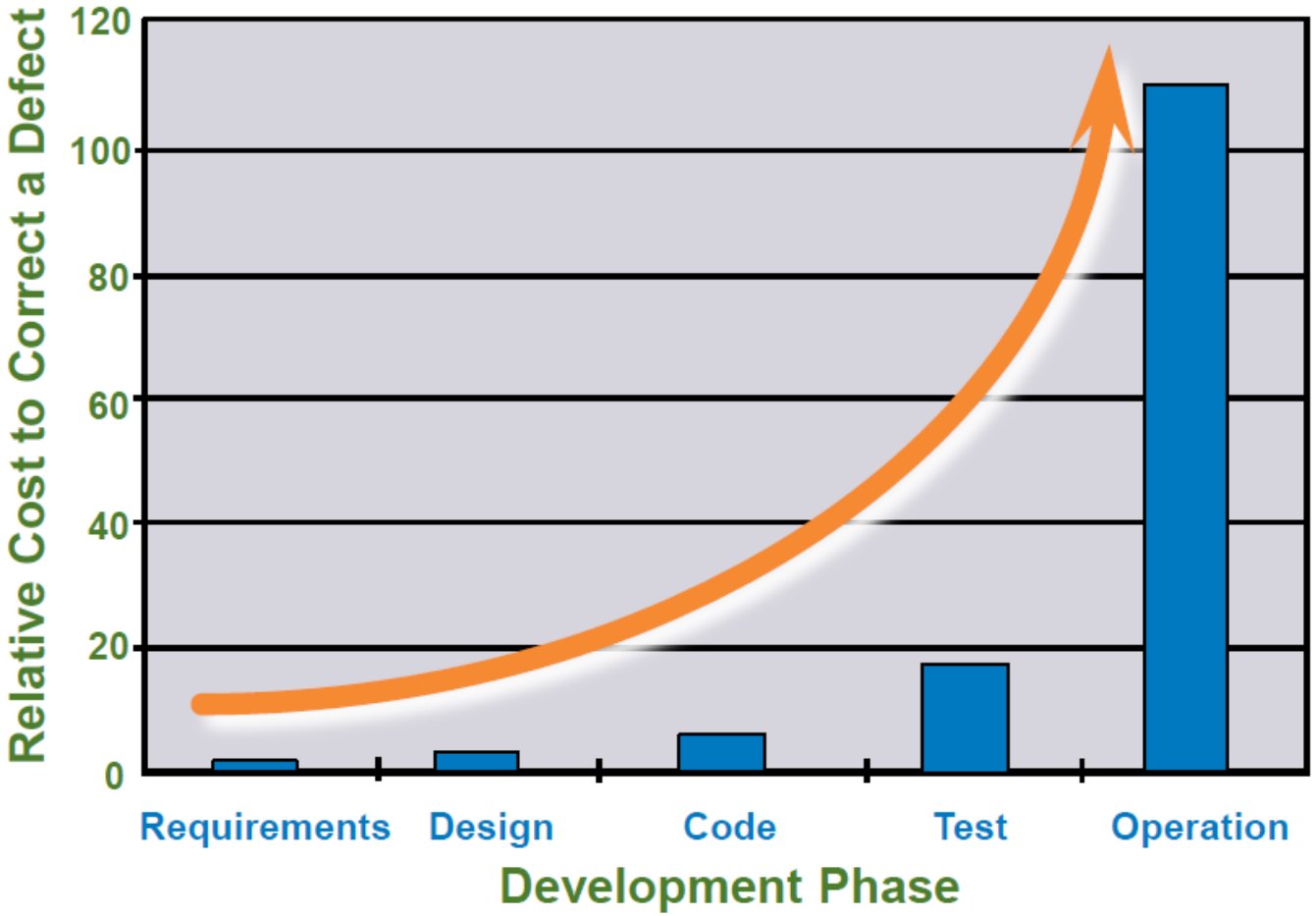
Relative Cost to Fix a Defect



From: Software Peer Reviews – An Executive Overview, by Karl Wiegers, 2012 . Used by permission.

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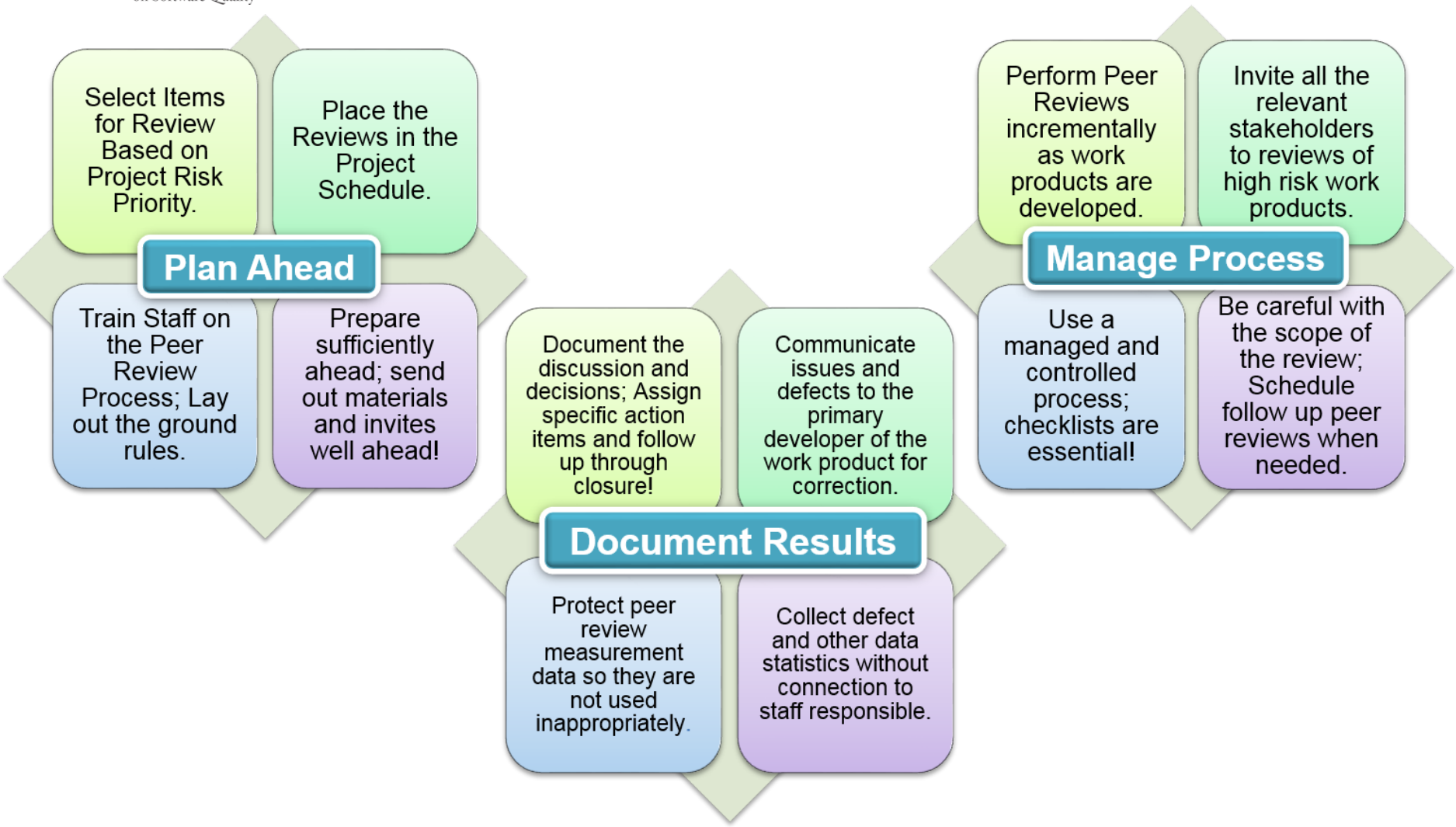
Essential Principles - "Do"



Be respectful and affirming of others' opinions, comments, and suggestions.

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Things To Avoid – "Don't"

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What to Peer Review

Review selected work products from the whole SDLC!

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Cross-Cultural Cautions!

Some People/Cultures/Staffs may have these issues and each must be carefully researched and addressed:

- Resistance to change
- Fear of public criticism
- Fear that defect data will be used in their evaluations
- Direct criticism is not accepted in some cultures
- A focus on individual rather than team effort (or visa versa)
- Preference for fixing defects, not preventing them
- Previous negative experiences with Peer Review
- Dictatorial managers who overrule decisions

From: *The Soft Side of Peer Reviews*, Karl Wiegers, 2003
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Recent Studies Show:

- Most Defects found in pre-meeting analysis.
- Meetings should focus on agreeing on these defects (not finding them)
- Lack of clarity should be identified as a defect.
- Shorter meetings produce high defect discovery.
- Best meeting length is about 60 minutes.
- 200 – 400 lines of code (LOC) per review is best.
- Reviews may be just as effective over email, etc.
- Demonstrations or visualizations are efficient for peer and customer feedback.
- These discoveries fit very well with Agile projects.

From: *Brand New Information – What modern literature has to say about code review; what studies do and don't agree on.* Quoted in **Best Kept Secrets of Code Review**, Jason Cohen, 2006, pp 59-60. Used by Permission.

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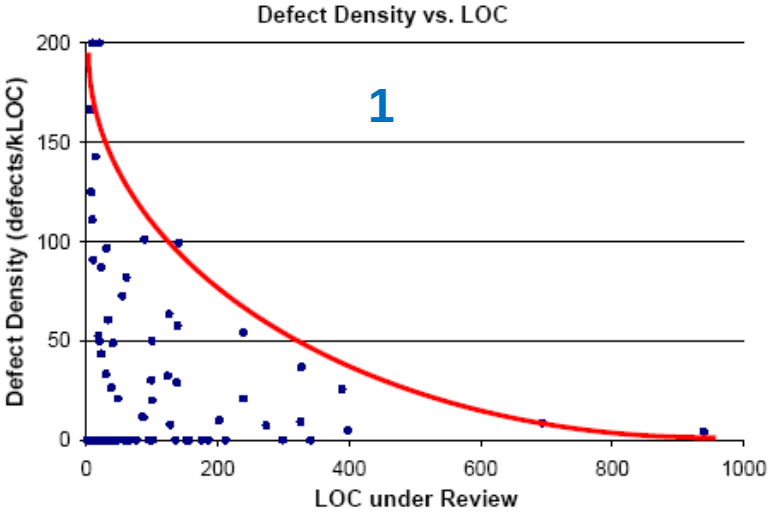
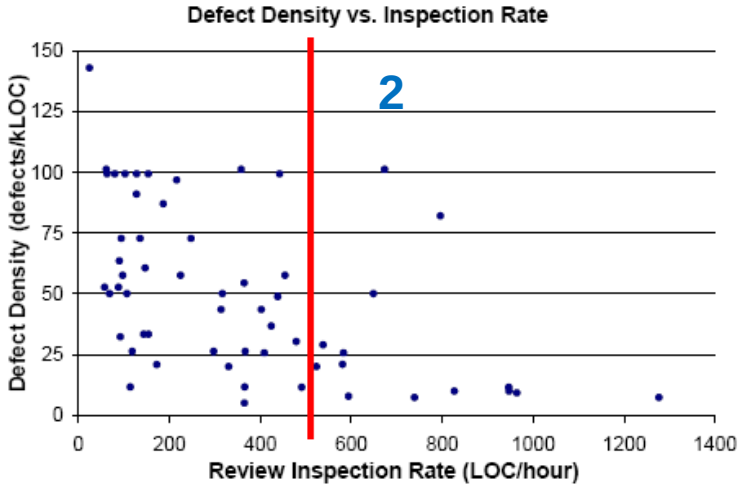
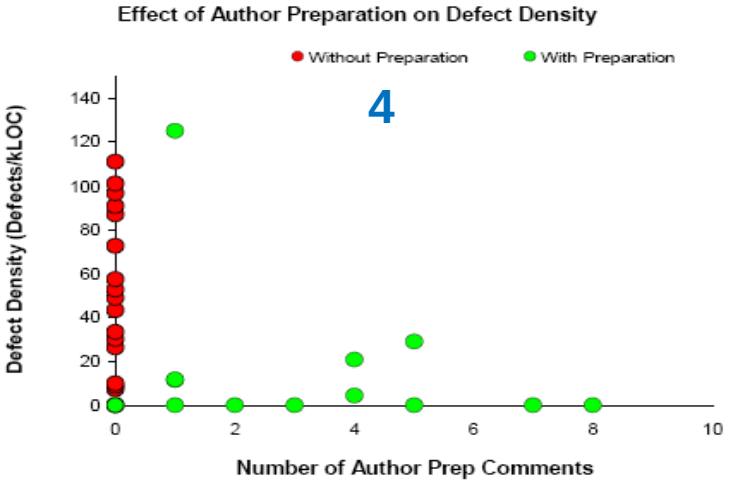
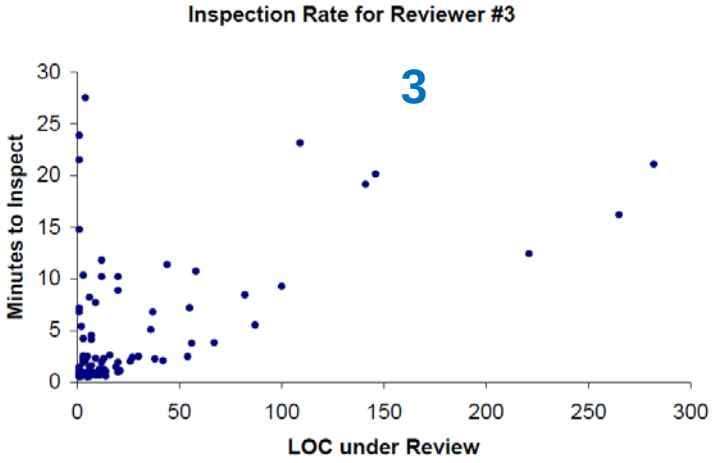
Research Data on Code Peer Review









From: *Lightweight Code Review Episode 4: The Largest Case Study of Code Review, Ever,* by Jason Cohen

Part 3

Preparation for Peer Reviews

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Keys For Preparation

- Use a Standard Process
- Review the Complete SDLC
- High Risk Items First
- Address Resistance
- Prepare & Maintain Checklists
- Review Items Ahead
- Consider Alternative Type Reviews
- Use Electronic Tools/Media
- Apply Lessons Learned

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Overcoming Resistance

- Educate the staff on “why”
- Train the staff on “how”
- Encourage cultural change
- Encourage collaboration
- Lead by example
- Set expectations
- Focus on improving the product not criticizing the person
- Reward results

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Law of Diminishing Returns

- Probability of undiscovered defects
- Potential loss associated with the defects
- Cost of additional peer review
- Benefits of more peer review

From: Risk-Based Peer Review, Linda Westfall. Used by Permission.

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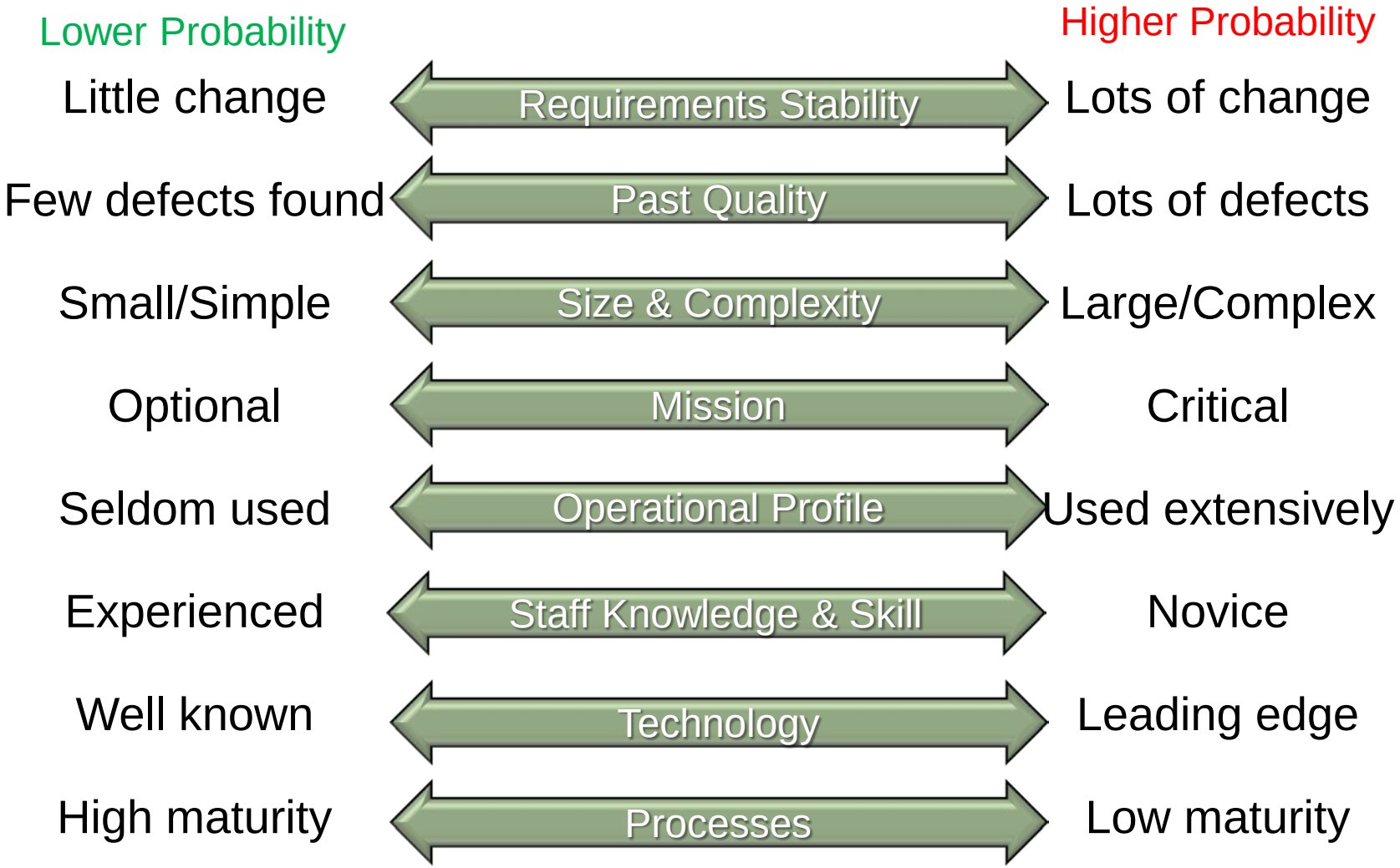
Risk Probability Indicators for Peer Reviews



From: Risk-Based Peer Review, Linda Westfall. Used by Permission.

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Great Tools Only Help When…

You Have Clear "Blue Prints"

- Process Diagrams
- Process Instructions
- Process Definitions
- Process Training
- Organizational Guidance
- Quality Assurance Activities
- Produces Alignment between People-Process-Tools

Part 4

Practice of Peer Reviews

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Key Practices of Peer Review

- Keep the process simple
- Encourage improved communication
- Document formal & informal
- Document how tools are used
- Document criteria for selection
- Improve checklists from experience
- Document only relevant measures
- Use measures to prove benefit
- Plan to continually improve

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Using Peer Review Checklists

- Manual Use
- Tool Use
- Common Templates
- Quick Reviews
- Check for Common Errors
- Individuals or Groups
- Easily Modified
- Improved through Feedback

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Formal vs. Informal Reviews

Formal

- Highly defined process & training
- Clearly defined participant roles
- Nearly always scheduled
- Must use checklists
- Defined review objectives
- Should involve several persons
- Can be a walkthrough
- Must collect defect measures
- Must report measures to management
- Must do Lessons Learned for feedback

Informal

- Defined lean process
- No defined participant roles
- Often unscheduled
- May use checklists
- May involve only one other person
- Can involve several persons
- Can be a pass around document review
- Can be an over the shoulder code review
- Should collect defect measures
- Should report measures to management

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Measures of Peer Review

Defects

Defects found during peer review – actual number of errors

Defects defined by useful category type (i.e. missing, wrong, standards, unclear, improvement, etc.) *

Defect density – average number of errors found per line of code/page of document/requirement description

Root Cause Analysis process should be applied to major defects

Peer

Peer inspection rate – number of errors found per hour

Peer inspection effectiveness – number of errors found during peer review compared to total errors found

Peer time spent in review – Total time and average time by review – total time before and during the review meeting

***Note**: its very useful to compare apples to apples in code review defects and testing defects – so categorize these in the same types as much as possible for comparing trends and percentages by type.

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Improve Communication

- **Use "I" statements instead of "You"**
  - ✓ I am not clear. What is this variable referring to?
  - ✓ I did not see what this reference refers back to.

  - NOT: You missed defining that variable (dummy)!
  - NOT: You didn't call the correct reference, did you?

- **Explore and observe; don't accuse**
  - ✓ The SRS is missing the transfer requirement.
  - ✓ How can we clarify some of these complicated requirements?

  - NOT: You guys missed the transfer requirement!
  - NOT: You still have not learned to write requirements!

Part 5

Power of Peer Review

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Keys to Power of Peer Reviews

- A different perspective.
- Less rework.
- Fewer bugs and errors.
- Improved communication.
- Better team cohesiveness.
- Project/module familiarity.
- Pride/Recognition.
- The ability to assess and accelerate progress.

From: http://www.techrepublic.com/article/developers-guide-to-peer-reviews/

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Social Benefits of Peer Review

- We all have trouble seeing our own mistakes
- Senior staff mentor junior staff
- Discussion brings new ideas
- Motivates for improved conscientiousness
- Lessons Learned are passed on to others
- Communicates institutional knowledge
- Facilitates code and document maintainability

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How will You Benefit?

Developers/Maintainers

- Shorter development time
- Increased productivity
- Improved teamwork and product understanding
- Confidence that requirements are correct
- Reduced unit testing time
- Less debugging during system testing
- Reduced product support demands from customer
- Reduced overall maintenance

Requirements/Testers

- Earlier correction of erroneous requirements
- Fewer untestable or missing requirements
- Better understanding of the product thru design reviews
- Customer validation reviews
- Improved test design
- Less test time needed
- Testers may focus on most difficult issues
- Better data for managers to make release decisions

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Measurable Reported Benefits

- It is well-documented that the earlier a bug is found the cheaper it is to fix. Fixing a bug in QA is more than twice as expensive as finding it in development.
- Shell Research saved an average of 30 hours of maintenance work for every hour invested in inspections.
- Inspection of a 20,000 line program at IBM saved more than 85% of programmer/tester effort by detecting major defects through code review instead of testing.
- In fact, a NASA study found that code review detected almost twice as many defects per hour as testing.

From: ***Why Review Code?*** By Jason Cohen. Used by permission.

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Code Defect Removal Efficiency

Defect Identification Rates*		
Action	Detection Rate (mode)	Rank
Self check design	35%	
Formal group design review	55%	2
Formal code review	60%	1
Self check code	40%	5
Unit testing	25%	
Integration testing	45%	4
Field testing	50%	3

*Jones, Capers. "Programming Productivity" 1986, McGraw Hill.

Referenced at: David Read. *Code Reviews Trump Unit Testing , But They Are Better Together.* "Dave's Reflections" Blog Post referenced 20 January, 2015. http://monead.com/blog/?p=1291

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Defects Found Earlier in SDLC

Number by Release	Peer Review	Development	Other	Test	UAT	Production	Grand Total
3.11	84	2	2	88	34	18	229
3.12	47	1		40	11	10	109
3.13	94	1		44	7	1	147
3.14	16			7			23
Grand Total	241	4	2	179	52	29	508

Percent by Release	Peer Review	Development	Other	Test	UAT	Production	Grand Total
3.11	37%	1%	1%	38%	15%	8%	100%
3.12	43%	1%	0%	37%	10%	9%	100%
3.13	64%	1%	0%	30%	5%	1%	100%
3.14	70%	0%	0%	30%	0%	0%	100%

Part 6

Personal Resources for Peer Review

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Top 10 Key Action Items

1. Research the recommended resources.
2. Download Karl Wiegers' templates.*
3. Keep your modified process simple.
4. Peer Review the process with entire team.
5. Select work products from entire SDLC.
6. Schedule highest risk items first.
7. Keep group sessions to about 1 hour.
8. Measure what relates directly to other defects.
9. Use measures to prove value of Peer Reviews.
10. Use Lessons Learned sessions for improvement.

*Shown on upcoming slide.

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Wiegers, Karl. *Goodies for Peer Reviews.* Sited 6 Jan. 2015.
http://www.processimpact.com/pr_goodies.shtml (Highlighted on next slide.)

Note: a handout of references and best practices will be provided.

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Peer Review Templates

Webinars
eLearning
Products
Good Books
Links
Biography
e-Mail

These documents and links are presented to assist your practice of software peer reviews. You are free to use these items and to modify them to best suit your needs. You may **NOT** sell them, adapt or incorporate them into any commercial product or service without permission from Process Impact, or post them on any web site accessible outside your company.

Payments received for these items are donated to the Norm Kerth Benefit Fund to help a software consultant who has been disabled since 1999 with a traumatic brain injury. You may also make additional donations to this fund. Thank you for your support.

Process Assets for Software Peer Reviews and Inspections

View Cart

Set 1, Process Description: $5.00: Add to Cart

Peer Review Process Description (preview)

Set 2, Defect Checklists for Reviews: $5.00: Add to Cart

Requirements Specifications
Architecture
Detailed Designs
Source Code (Generic)
C++ Source Code
Java Source Code
Test Plans
Project Plans

Set 3, Review Forms: $5.00: Add to Cart

Inspection Summary Report
Inspection Issue Log
Peer Review Typo List
Inspection Moderator's Checklist
Inspection Lessons Learned Questionnaire

Set 4, Inspection Data Spreadsheets: $5.00: Add to Cart

Spreadsheet for code inspection data
Sample code inspection data spreadsheet
Spreadsheet for document inspection data
Sample document inspection data spreadsheet

Tools to Assist with Software Peer Reviews

- Codestriker is an open-source web-based application that supports online code reviewing. It's available under the GNU public license. Codestriker integrates with several version-control and defect-tracking tools.
- Code Collaborator from SmartBear Software is a Windows-based commercial tool that facilitates code review by remote reviewers. It builds an audit trail of review activities and integrates with several commercial version-control products.

From: http://www.processimpact.com/pr_goodies.shtml

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Peer Review Software Tools

Atlassian Crucible - provides code review configurable for Subversion, JIRA, CVS, Perforce, Eclipse and more.
https://www.atlassian.com/software/crucible/overview

Atlassian Fisheye - provides a read-only window into Subversion, Perforce, CVS, Git, and Mercurial repositories for reviews.
https://www.atlassian.com/software/fisheye/download

Code Collaborator by SmartBear – Code review combined with document review. Configurable for CVS, Subversion, Git, Mercurial, MKS Integrity, ClearCase, Eclipse V3.4 and higher, Perforce, TFS, Visual Studio, and others.
http://smartbear.com/products/software-development/code-review/

Code Reviewer by SmartBear - a freeware tool for code review.
http://codereviewer.org/

Code Striker - for web-based code reviewing.
http://codestriker.sourceforge.net/

Code Review Tool by Protium - a freeware code review tool configurable for Perforce, Subversion, GitHub, and Team Foundation Server.
http://codereviewtool.com/Faq

Review Board - an open source tool and a paid version; drag-and-drop any file onto a review request, and your team can leave comments on it.
https://www.reviewboard.org/get/

Note: Many of these have free 30-day trials.

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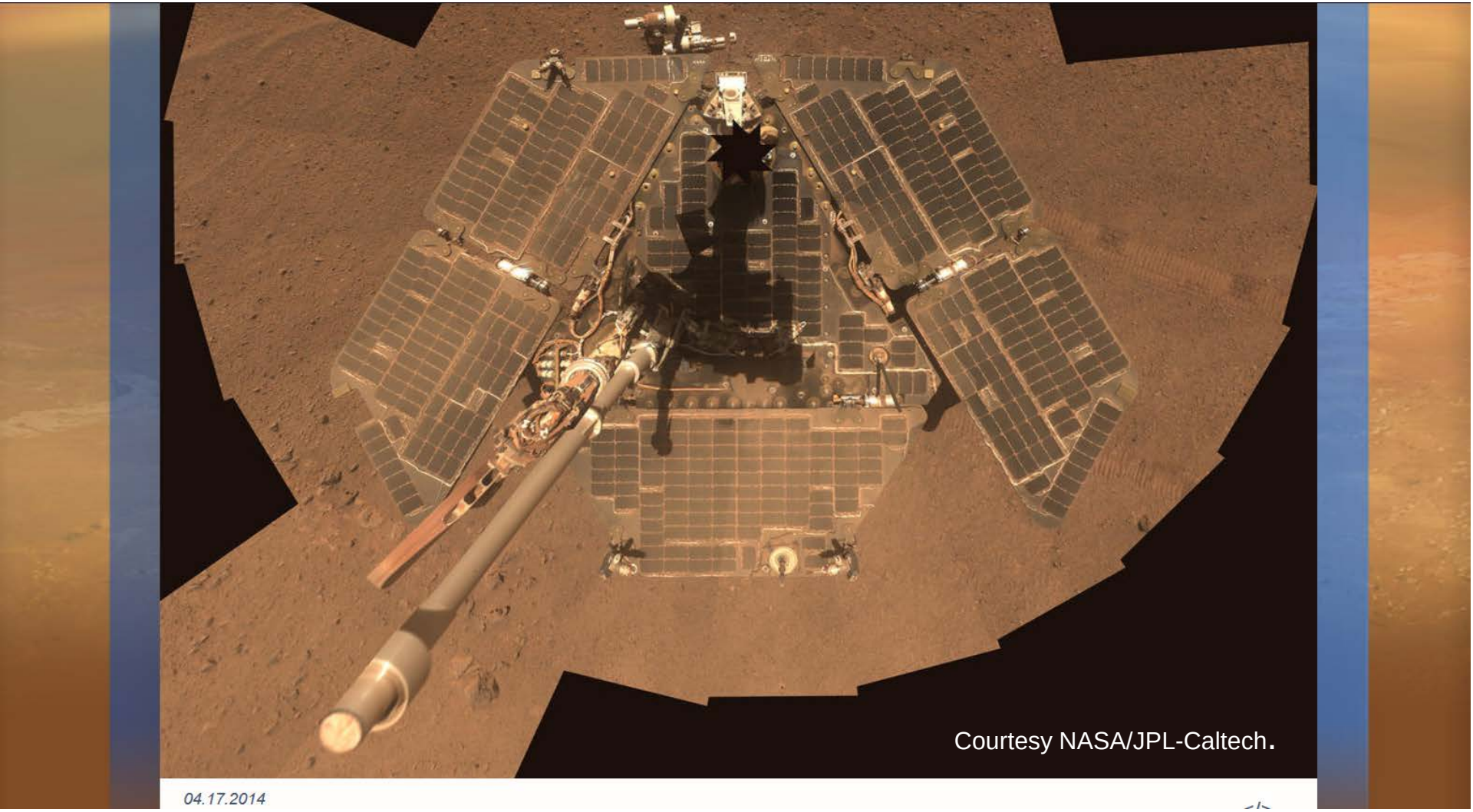
Opportunity Mars Rover "Selfie"



From: http://mars.jpl.nasa.gov/multimedia/images/?ImageID=6177

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Questions