



# VERIFICATION IN CMMI USING PEER REVIEWS

---

5<sup>TH</sup> ANNUAL CMMI TECHNOLOGY CONFERENCE  
AND USER GROUP  
NOVEMBER 16, 2005

---

ELECTRONIC SYSTEMS LABORATORY  
Georgia Tech Research Institute  
Georgia Institute of Technology

Authors: Jeanne Balsam, Jean Swank, Lee Sheiner,  
And Mark Pellegrini

[jeanne.balsam@gtri.gatech.edu](mailto:jeanne.balsam@gtri.gatech.edu)

[jean.swank@gtri.gatech.edu](mailto:jean.swank@gtri.gatech.edu)

[lee.sheiner@gtri.gatech.edu](mailto:lee.sheiner@gtri.gatech.edu)

[mark.pellegrini@gtri.gatech.edu](mailto:mark.pellegrini@gtri.gatech.edu)

*This page intentionally left blank.*

# Verification In CMMI Using Peer Reviews

AUTHORS: JEANNE BALSAM, JEAN SWANK LEE SHEINER, AND MARK PELLEGRINI

---

## INTRODUCTION

---

Georgia Tech Research Institute (GTRI) is the nonprofit applied research arm of the Georgia Institute of Technology in Atlanta, GA. The Electronic Systems Laboratory (ELSYS) of GTRI achieved a CMM Level 3 rating in June of 2003. ELSYS employs 150 engineers and scientists working predominately on DoD related competitively bid contracts. Over the last 30 years, ELSYS researchers have established national reputations in areas such as: monopulse countermeasures, advanced radar warning receiver design, survivability, simulation models and analysis, and Electronic Countermeasures (ECM) technique development. GTRI/ELSYS core competencies include software and systems engineering for electronic warfare and avionics systems, reliability and maintainability upgrades, technology insertion, obsolescence programs, threat analysis, and mission critical software.

This paper describes the Peer Review process utilized by GTRI/ELSYS. The procedures were developed originally to meet CMM for Software requirements. Over the last three years those processes have been extended to cover all systems components. These reviews can also aid in the validation of the product, if planned effectively and with the correct reviewers. Key features of effective peer reviews include:

- Selection of proper type of peer review for each work product and phase of development.
- Selection of peer reviewers who have the required knowledge and independence
- Detection of defects early in the lifecycle
- Reduction of risk of latent defects
- Documentation of defects and tracking them to resolution
- Utilization of supporting tools and environments for effective reviews
- Configuration management of review and reference material

Other benefits of peer reviews include:

- Consistency in the use of engineering standards and practices
- “Cross-pollination” of ideas and methods across the organization

If your organization is considering employing a peer review process you should find this information helpful in getting started. If you are already regularly conducting peer reviews you might find some of the topics discussed helpful in fine-tuning your process.

# Verification In CMMI Using Peer Reviews

AUTHORS: JEANNE BALSAM, JEAN SWANK LEE SHEINER, AND MARK PELLEGRINI

---

## THE CMMI VERIFICATION PROCESS AREA

---

Peer reviews were a “Key Process Area” in the Capability Maturity Model (CMM) for Software. Under CMMI peer reviews are defined as a specific goal in the CMMI Verification process area. Essentially, the CMMI guidelines correctly classify peer review as a method of verification. Other methods of verification include, but are not limited to, audits, analysis, simulations, testing, and demonstration. Peer reviews (inspections, structured walkthroughs) can be one of the most cost-effective and productive tools you can use to create robust products on schedule and within budget. That is their theoretical potential. Without the other components (specific goals) of Verification, Prepare for Verification and Verify Selected Work Products, peer reviews lose value. For peer reviews to be effective they must be planned to take place throughout the lifecycle of the product. Additionally, verification procedures and criteria must be in place along with an environment that facilitates the peer review process.

There are several important objectives that peer reviews can accomplish.

### **Identify Defects Early**

Early identification of defects is extremely important, and the ability of peer reviews to ferret out defects before they become expensive to fix is probably their single greatest benefit. A defect in requirements may only take a few hours to address and correct. If that same defect makes it from requirements into design and implementation, and is not caught until testing, it might take hundreds of hours or more to fix, as well as make it impossible to deliver the product on schedule and within budget. Early detection pays big dividends.

### **Verification**

Peer reviews, or other verifications must be scheduled throughout the lifecycle of the system. Verification is the act of verifying that a work product is being built which implements the requirements of the system. As the Reviewers look at a work product, they should make sure that it is consistent with the work products produced earlier in the life-cycle. For example, the Reviewers need to verify that the design is not only feasible to implement, but implements the requirements placed on the module. Likewise, a peer review of a module’s implementation should be verification that it accurately implements its design. Thus in all phases of the lifecycle the work products are verified against previous work products and against the system requirements.

### **Gain Confidence in Work Products**

For project directors and technical leads, peer reviews increase their confidence that the team is making progress towards product completion. Setting the correct criteria for peer reviews and making a peer review the gate that a work product must pass prior to being considered complete provides the project director and technical leads with concrete information on which to base their plans. By peer reviewing work products one reduces the probability that some critical link is weak in the chain from requirements to a finished product.

# Verification In CMMI Using Peer Reviews

AUTHORS: JEANNE BALSAM, JEAN SWANK LEE SHEINER, AND MARK PELLEGRINI

## **Reduce Risk**

By identifying defects early in the product life-cycle, peer reviews help reduce the risk of late delivery, a bad product, or an overrun. This benefit is achieved by performing peer reviews during each phase of a product's development. Early identification of risk areas allows for development of effective and timely project risk-mitigation strategies.

---

### **PLANNING PEER REVIEWS**

---

Peer reviews don't just happen by themselves. They must be a part of project planning, otherwise sufficient resources will not be allocated to support them. Not only must time and budget be considered and planned, but critical personnel resources may need to be secured through formal commitments. At a minimum, peer reviews of important work products need to be scheduled as tasks on the project schedule. In ELSYS, peer reviews are required for requirements, design, and test procedures, so these peer reviews are part of the normally scheduled project activities. Peer reviews of selected code units are also required and scheduled. Placing these peer reviews on the project schedule not only assures that they are planned, conducted and closed, but also assures that they are specifically funded when budgeting for product development.

All peer reviews can not be pre-planned at the being of a project. As with all major project tasks management reserve should be set aside for follow-up peer reviews and additional peer reviews, which are scheduled for new or modified components.

---

### **WHAT AND WHEN TO PEER REVIEW**

---

It is essential to conduct peer reviews at appropriate points in product development. Finding defects early in the product development process (i.e. requirements and design) provides the greatest return on investment. The ELSYS process requires that a Structured Walkthrough is conducted on all documentation (e.g., Word Document, slides, video, etc.) of requirements and designs. Test plans and test descriptions must be peer reviewed with at least a Desk Check, and in practice it is preferred that they be reviewed with a Structured Walkthrough that includes key designers and implementers of the product being tested. Deciding what to review when peer reviewing implementations is less straightforward when considering systems. Software development and hardware development have specific implementation details that warrant discussion. The following paragraphs provide some guidance on deciding the type of peer reviews that should be scheduled and major concerns specific to each type of development.

## **Software Implementations**

In an ideal world, all code units would be peer reviewed with at least a Desk Check. We do have some projects where that is a requirement, particularly ones that are mission-critical. But sometimes the amount or severity of the defects found may not justify the expense to find them as compared to discovering them in unit testing or acceptance testing. In these cases a judicious use of limited peer

# Verification In CMMI Using Peer Reviews

AUTHORS: JEANNE BALSAM, JEAN SWANK LEE SHEINER, AND MARK PELLEGRINI

reviewing resources is warranted. The goal is to select a sub-set of code units for peer review. The following paragraphs provide guidance in that selection.

If the project team is using some new language or other new technology, a Structured Walkthrough of one of the first units produced is recommended. This will give the entire project team a chance to share their insights into the new tool using a real-world example. All who participate can benefit, not just the Producer of the product being reviewed.

Code that is written by someone who is inexperienced and/or new to the project team is a good candidate for peer review. In these cases it is especially important to conduct some type of peer review as soon as possible, preferably with their first code unit. If there are problems with coding standards, implementation approaches, or other aspects, it is important to find and correct these problems before they have been replicated in a large number of coded units. As always, early detection brings the most benefit.

Critical units are also good candidates for peer reviews. If a unit is essential to the performance of the product it should be peer reviewed. For example, a base class from which numerous other units are derived should usually be examined. A defect in this class might cost significant debugging time for many developers, magnifying the cost of the defect. Code units that are complicated and hence prone to errors, such as implementations of complex algorithms, are also good candidates for review. If the software is time-critical, units that are expected to be executed the most during run-time should be reviewed with an eye towards efficient implementation.

## Hardware Implementations

By hardware implementations we are referring to the detailed construction designs from which functioning hardware can be fabricated. This includes circuit board schematics, fabrication drawings, etc. When deciding what hardware implementations should be peer reviewed, if the schedule or resources permit only a sampling of some work products, the same types of criteria that apply to software apply here as well. Implementations using new technologies, created by inexperienced producers, or ones that are critical units are good candidates for peer reviews.

For hardware items a further consideration is critical path and schedule. A long-lead item would be a candidate for peer review if it is in the critical-path. The cost of peer reviewing the implementation might be significantly more than the cost of the item itself, but a peer review would still be justified if a schedule slip would be extremely costly or multiple items are being produced.

---

## REASONS FOR FORMALIZING THE VERIFICATION PROCESS

---

If you have never participated in a peer review, you may be wondering exactly what a peer review is. Actually, it is likely that you have already participated in many peer reviews without even knowing it. Walking down the hall and asking a co-worker to look at something you have produced is essentially a peer review, boiled down to its simplest form. You throw something on your friend's desk and ask, "Does this look right to you?" You are asking them to look at your work product and try to find defects in it. If you sit down with someone and discuss an approach you are thinking about using in a design, that is a peer review too.

# Verification In CMMI Using Peer Reviews

AUTHORS: JEANNE BALSAM, JEAN SWANK LEE SHEINER, AND MARK PELLEGRINI

These informal types of peer reviews are sometimes helpful, but are often ad-hoc, inefficient, or ineffective. A *verification process* takes this concept of seeking input from your peers and formalizes it. There are several excellent reasons for formalizing the verification process:

**Assure Peer Reviews Take Place** – Just because the potential exists for people to peer review each other's work doesn't mean that they actually do it. A formalized verification process defines what work products should be peer reviewed – and equally importantly – when they should be reviewed.

**Select the Right Reviewers** – A co-worker in the next office may be willing to look at your work product and give his opinion, but he may not be the right person for the job if what you are working on is outside his area of expertise. This means that not only will you be wasting his time, he will be wasting yours. And even worse, you might actually think that you've got a solid product because he didn't see any defects in it. He didn't see them because he was not the right person to be looking for them. A properly executed peer review process selects the right people to examine the product being reviewed.

**Record Defects** – Peer reviews produce a defect log that documents all of the problems in the work product that need to be corrected. Walking into a neighbor's office and spending a couple of hours discussing a design isn't helpful if by the time you get back to your office you've forgotten the details of his observations.

**Verify Defects are Corrected** – A list of defects is not only good for the Producer to use to address the defects in their work product; it is also good for someone to independently verify that the defects were fixed. Finding defects but not fixing them is a waste of resources and undermines the whole purpose of peer reviewing.

---

## RULES FOR PEER REVIEWS

---

It is vitally important to have some ground rules for peer reviews. Criticizing people's work is a touchy subject at best. Doing it in a public, documented forum can be inflammatory and frightening. This is a hurdle that must be overcome when introducing a peer review process to an organization. Setting and enforcing rules is essential. Active enforcement of these rules may be necessary at first, but once your team has become used to the process of peer reviews this becomes less of an issue. Don't forget that new employees will be in the same boat the entire organization was when the process was first introduced. They will need special attention to get them introduced to the peer review process that has become second-nature to everyone else.

### Rule 1: No Managers are Allowed in Peer Reviews

The purpose of peer reviews is to find defects, not to rate someone for evaluation purposes. Having a manager present at a peer review may stifle good communication. Reviewers may be inclined to hold back their criticism for fear of hurting the Producer's standing with their boss. And it is tough enough for a person to have problems in their work pointed out to them by their peers without the person determining their next raise sitting in the room with them.

# Verification In CMMI Using Peer Reviews

AUTHORS: JEANNE BALSAM, JEAN SWANK LEE SHEINER, AND MARK PELLEGRINI

As with any rule, there are always exceptions. If the manager has special expertise that is truly relevant to the work product being examined, an exception can be made. This special need for their expertise should be explained to the person whose work is being reviewed. The manager, if not already familiar with the peer review process, should understand that all peer reviews find defects, and this should not reflect poorly on his perception of the employee's work.

## **Rule 2: Peer Review Results are Confidential**

Obviously if defects are recorded and shared among the peer review team, they are public to some extent. But specific peer review data should not be made generally available to people outside the project team. Metrics being collected for process evaluation should be aggregated when published to provide anonymity. The peer review team should use appropriate discretion and keep discussions confidential.

## **Rule 3: Review Products, Not People**

Peer reviews are intended to find problems with work products, not the people who produced them. Under no circumstances should personal criticisms be allowed. The common enemy of everyone is the bugs lurking in the work products, and it takes a team effort to find them. This should be made clear to everyone who participates in a peer review. And don't let the Reviewers forget that it will soon be their turn to have their own work reviewed.

## **Rule 4: Expect to Find Defects**

Once peer reviews become common, it will be obvious to everyone that all work products have defects. If your peer reviews aren't finding defects, you either have the wrong Reviewers, insufficient preparation, or you are targeting the wrong products. However, when peer reviews are new to the organization (or a new employee) it is a bit intimidating to have your peers compile a list of the defects in your work. Let everyone know up front that every work product has defects and their objective is to find them. Finding these defects benefits the product, and therefore the whole team.

## **Rule 5: Peer Reviews Convey No Retribution**

There should be no negative consequences from participating in a peer review. Nothing that is related to a peer review should appear in evaluations or personnel files. It is essential for participants to be confident that what happens in a peer review is strictly a technical exercise for improving the group's work products and not something that will come back to haunt them.

# Verification In CMMI Using Peer Reviews

AUTHORS: JEANNE BALSAM, JEAN SWANK LEE SHEINER, AND MARK PELLEGRINI

---

## TYPES OF PEER REVIEWS

---

ELSYS utilizes the four types of peer reviews briefly described below. The vast majority of our reviews are either Structured Walkthroughs or Desk Checks. Formal Peer Inspections are very rare.

### **Formal Peer Inspections**

Formal Peer Inspections are typically only used in life-critical applications. A Formal Peer Inspection is a rigorous analysis technique, and thus is the most costly and time consuming of the four review techniques. Formal Peer Inspections must include domain experts from outside the project team. During the inspection, defects are identified and logged, and action items are assigned. The status of defects are tracked and communicated until the defect has been resolved. Formal inspections have the highest efficiency in terms of defect removal of any form of peer review.

### **Structured Walkthroughs**

Structured Walkthroughs are similar to Formal Peer Inspections, but require fewer Reviewers and shorter preparation times. A Moderator guides the other members through the review of the work product, with the Producer(s) walking the group through the product. The participants ask questions and make comments about possible defects, violations of development standards and other problems. During the Walkthrough, defects are identified and logged, and action items are assigned. The status of defects are tracked and communicated until they are resolved. Structured Walkthroughs are less efficient at removing defects than Inspections, but are not as costly and require a smaller number of Reviewers.

### **Desk Checks**

Desk Checks are private reviews carried out by a Producer and an experienced Reviewer. The Producer provides the Reviewer with a copy of the work product and associated materials. Desk Checks are the least expensive of the four review techniques. However, Desk Checks are the least effective review method and the effectiveness of the review depends almost entirely on the competence of a single Reviewer.

### **Round-Robin Reviews**

Round-Robin reviews are a process of desk checking by multiple peers in a sequential manner. The initial Reviewer, who serves as the Moderator, completes a Desk Check and then passes the folder to the next Reviewer who performs another Desk Check, logging additional defects. This continues until all Reviewers have participated and the folder is returned to the Moderator, who then works with the Producer to ensure that defects are corrected. Round-Robin reviews are more efficient than simple desk checking, and typically cost less than Inspections and Walkthroughs. However, Inspections and Walkthroughs identify a greater percentage of defects.

# Verification In CMMI Using Peer Reviews

AUTHORS: JEANNE BALSAM, JEAN SWANK LEE SHEINER, AND MARK PELLEGRINI

---

## PREPARING FOR A PEER REVIEW

---

Having a successful peer review is dependent upon proper preparation. The correct Reviewers must be chosen, the review must be scheduled, and the work products to be reviewed and defect logs must be properly controlled.

### Choosing Participants

A Reviewer must have adequate knowledge of the work product being reviewed. Simply choosing someone to be a Reviewer because they have the time to do it despite the fact that they don't understand what they are reviewing is a waste of time and money. In the case of software products, the Reviewer should be familiar with the programming language, the application that is being developed, and the system to which it is being integrated. Likewise for hardware, the Reviewer should understand the tools and technologies being used.

It is also important for Reviewers to be able and willing to spend adequate time preparing for the review. When they are invited to participate in the peer review they should be told the minimum amount of time they are expected to spend to prepare for the review. If they cannot commit to this amount of time you should consider using another person as a Reviewer, or if the desired Reviewer is considered essential, rescheduling the review. Although in some cases peer reviews can be done "cold" (i.e. no advanced preparation), in most cases reviewing the material in advance is essential. Having a peer review with an unprepared Reviewer is generally "just checking the box," which may give the appearance of conducting a peer review, but is largely a waste of time. It can also hurt your peer review process in the long run by leaving defects undetected, giving the impression that the process is not worthwhile.

A Desk Check will have a single Producer and a single Reviewer. The choice of Producer(s) is straightforward – the person or people who created the work product. The choice of Reviewer, however, is more difficult and extremely critical if the peer review is to add value rather than waste money.

Round-Robins, Structured Walkthroughs, and Formal Peer Inspections employ multiple Reviewers. In these types of reviews it is not essential for each Reviewer to be an expert in everything, but between them they should possess the knowledge to understand the work product in its entirety. It is highly desirable to select at least one Reviewer from outside the project team. Having a Reviewer with a totally different perspective increases the chance of finding defects or better implementation methods. This also fosters cross-communication between projects.

A Moderator's primary responsibility is to run the peer review meeting. It is his job to be sure that all of the Reviewers participate and that no single Reviewer dominates the meeting. The Moderator must keep the meeting progressing and stop off-topic conversations that sometimes are a natural consequence of the discussion of the work product, but are not related to the goal of finding defects. It is understandable that people try to fix the defects they find during the meeting, but this is not its purpose. The Moderator must prevent problem-solving from displacing the goal of problem-finding. He must maintain a civil atmosphere during the meeting. The Moderator must be sure that the Recorder is capturing the defects correctly, and with enough detail that the Producer will understand the defect later, when it is time to correct the defect.

# Verification In CMMI Using Peer Reviews

AUTHORS: JEANNE BALSAM, JEAN SWANK LEE SHEINER, AND MARK PELLEGRINI

## **Scheduling**

Peer reviews need to be scheduled far enough in advance to allow people to plan around them. This means that the reviews are normally scheduled before the work product is ready for review, anticipating the date that it will be ready. If the work product is not ready on schedule, the amount that it slips will cut into the cushion that you have allowed the Reviewers in their schedule. If this happens, you must either reschedule the review or verify that the Reviewers can adjust their schedules and complete the minimum amount of preparation by the meeting date. If they can't prepare adequately, a decision must be made as to whether the investment in the meeting time will still be a good one if the Reviewers go in with little or no advance preparation. Conversely, it is also useful to put a maximum limit on preparation time, particularly if budgets are tight. Although our experience is that getting too little preparation is more of a problem than too much, you may occasionally get someone who makes preparing for a review a full-time job when you intended for them only to spend a few hours doing so.

## **Reviewer Instructions**

Reviewers should be given their priorities in their review preparation, particularly if the time available for preparation is limited. Different Reviewers may have different fortes. One Reviewer may be particularly good at spotting coding errors, whereas another may better understand the requirements allocated to the module in the context of the system of which it is a part. For example, a piece of code may work correctly, but not do the job it needs to do. This is a requirements issue. On the other hand, the code may appear to be doing the right thing, but the code contains a statement that uses a logical OR operation when a bitwise OR was intended. This is an implementation issue.

## **Meeting Length**

The actual peer review meeting should be limited to two hours or less. After this length of time minds begin to wander as fatigue sets in, reducing the quality of the review. If the review cannot be completed within two hours, another meeting should be scheduled to complete it. Care should be taken when planning the meeting so as not to attempt to review too much material. If it is obvious that the work product is too large to be reviewed in a single meeting it should be broken down into smaller units, if possible, or scheduled with multiple meetings.

## **Controlling Review and Reference Material**

It is vitally important that the work product being peer reviewed is under configuration management. If the work products are not being controlled you are peer reviewing a moving target. When Reviewers are told to begin their preparation they should be given specific revisions of the work product to review. The forms they use to record their findings should also document which revisions of the products they are reviewing. These forms themselves should be placed under configuration management control. The Reviewers should also be given a list of any reference materials they will need to adequately assess the product being reviewed.

## **Facilities**

The facilities in which the review takes place can improve the convenience and possibly the quality of the review. A meeting room with a networked computer that hosts the configuration management tool provides convenient on-line access to materials to be reviewed, peer review forms,

# Verification In CMMI Using Peer Reviews

AUTHORS: JEANNE BALSAM, JEAN SWANK LEE SHEINER, AND MARK PELLEGRINI

and reference materials. A projection system can be used to display the computer screen's contents to all attendees. That content may be the work product under review, reference documents, or defect logs. Easy access to a printer capable of printing multiple size documents facilitates viewing anything that is hard to view via the projection system.

---

## CONDUCTING A PEER REVIEW

---

In the case of Structured Walkthroughs it is important for the Moderator to verify in advance of the meeting that all of the Reviewers are adequately prepared and have completed their defect logs. If some Reviewers are not prepared, a decision must be made to hold the review and take the time to walkthrough the work product line-by-line (referencing associated documentation) or to reschedule the review. This situation can usually be avoided if the Moderator periodically checks with the Reviewers and monitors their progress. Sometimes preparing for a peer review falls to the bottom of the Reviewers' priority lists; being reminded about it will usually get people motivated to prepare.

The Recorder should take all of the individual findings and combine them into a single list on the summary form prior to the meeting. When doing this it is helpful to keep the Reviewers' initials associated with their findings for easy author identification. The findings should be sorted so that similar ones from different Reviewers can be discussed together. Referencing the findings by the page, line, or paragraph number of the work product makes this sorting easier.

Although having the Reviewers record defects in advance is important, the meeting should not simply focus on a review of the findings. It is also important for the Producer(s) to walk the group through their work product as this will often initiate questions and discussions that may uncover defects that were not noticed by the Reviewers during their preparation.

It is extremely important that all defects are captured on the summary form. When defects are recorded it is essential that they are clear and specific. The Producer must agree that what is recorded is understandable because it will be his job to fix the problem. It is also important that the Reviewers agree that the defect is captured accurately; otherwise the Producer will fix a problem that doesn't exist and fail to fix the one that does. The Moderator needs to make sure that the discussion during the meeting doesn't get ahead of the Recorder. If it appears that the group is generating findings faster than the Recorder can capture them, the Moderator needs to stop the conversation to allow the Recorder to catch up.

The purpose of peer reviews is to identify problems, not fix them. Assuming that the Producer is competent, he can fix his own problems; he just needs help in finding them. Any time spent in the meeting fixing a problem is time spent by all the participants, so it is normally not cost-effective to determine solutions during the meeting. It also consumes valuable meeting time, since the meeting is limited to two hours maximum. Any time spent fixing a problem is time not spent looking for other ones. However, there can be exceptions to this rule. If the work product is small enough that there is no question that there will be sufficient time to finish the peer review, some latitude can be given to problem solving. Presumably the people gathered in the room are experts in the product being reviewed. If the Producer needs some assistance in solving the problem, and it doesn't require too much time to discuss, it may be better to do it during the meeting rather than try to reconvene

## Verification In CMMI Using Peer Reviews

AUTHORS: JEANNE BALSAM, JEAN SWANK LEE SHEINER, AND MARK PELLEGRINI

the subject-matter experts at another time. It may also be possible that the problem is such that the Reviewers have a vested interest in how it is solved. In this case you are going to need their agreement anyway, so figuring out how to solve the problem during the meeting may be appropriate. The important thing is to be sure that there is sufficient time to finish reviewing the material that is the subject of the review. In our laboratory we sometimes table discussions of problem-solving until the peer review is finished, and then spend the remaining meeting time discussing solutions for the problems for which it is appropriate to do so.

At the conclusion of the review a decision should be made as to whether another review is necessary. If the defects are simple and straightforward to correct, another meeting is not normally needed. But if there are numerous changes needed throughout the product, or if large sections of entirely new material need to be generated to address defects, another meeting is warranted. Sometimes a Structured Walkthrough can be followed up by a Desk Check if the changes needed are significant but not too overwhelming. If the work product is critical, or the changes are extensive, another Structured Walkthrough may be needed.

---

### CLOSING A PEER REVIEW

---

Although preparing for a peer review meeting and conducting the meeting itself is important, it is all for nothing if the defects that are found are never actually fixed in the work product.

Someone must be designated to verify that the work product is, in fact, corrected according to the findings generated during the review. In our process, the lead engineer verifies that the defects have been corrected and the project director signs the peer review form to indicate that he is aware of the completion of the peer review. We also have a project-independent quality engineer who verifies that the peer reviews have been closed in a timely manner.

Our process requires that defects must be closed within thirty days of the peer review meeting. If there are defects that cannot be addressed in that time-frame and they can be deferred, an engineering change request (ECR) is created to document that the defects exist and must be corrected when appropriate to do so. Opening the ECR allows the peer review to be closed, and the remaining defects are scheduled for correction through our normal engineering change request process.

# Verification In CMMI Using Peer Reviews

AUTHORS: JEANNE BALSAM, JEAN SWANK LEE SHEINER, AND MARK PELLEGRINI

---

## SECONDARY BENEFITS OF PEER REVIEWS

---

In addition to their primary purpose of finding defects in work products, peer reviews can have some very beneficial secondary benefits. Many of these benefits are dependent upon a well designed and managed peer review process.

### **Leverage Team Member Skills**

Hopefully you have at least one person in your organization who is so good at what he does that everybody wants him on their project; a “Super Star.” The reality is the Super Star cannot work full time on every project in the organization, but can be time-shared to bring expertise to multiple projects. The Super Star will typically need a relatively small amount of time to review a design and find its flaws as compared to the amount of time it took the Producer to generate the design in the first place. After it is fixed it may be nearly as good as if the Super Star had done the whole job himself.

### **Share Information Across Team Boundaries**

Peer reviews are a good opportunity for people to share information, particularly when some of the Reviewers are chosen from outside the project team. Peer reviews immerse developers who might otherwise never look at a colleague’s work in a process where they must do so. The inclusion of developers from other project teams in peer reviews helps to expose both teams to each other’s work and expertise.

### **Jump-Start Team Communication**

People on a development team, particularly if they don’t really know one another, sometimes communicate poorly. A peer review process imposes a structure on them where they must not only communicate, but do so in a manner that is centered on constructive criticism. Once they are used to the idea of critiquing each other’s work, they will find it easier to do so in informal situations. This is especially helpful to junior personnel, who might be uncomfortable with the idea of criticizing a more senior person’s work.

### **Create Mini-Milestones**

Scheduling a work product for a peer review adds another milestone to the product in addition to its completion milestone. The peer review date is typically scheduled in advance of the completion of the work product. This mini-milestone can motivate the producer to form a cohesive work product earlier in the product life-cycle, because it can be difficult or embarrassing to reschedule the meeting.

### **Increase Product Quality from the Start**

If the producer knows from the beginning that his work will be examined in a peer review, it is more likely he will follow good practices while crafting the product. This benefit extends to units that are not initially scheduled for peer review if there is some expectation that they might be inspected due to a planning change.

# Verification In CMMI Using Peer Reviews

AUTHORS: JEANNE BALSAM, JEAN SWANK LEE SHEINER, AND MARK PELLEGRINI

## **Expose Junior Staff to Expert Tutelage**

Peer reviews provide an ideal setting for junior staff members to interact with experts in their field. That interaction generally extends beyond the peer review through continued information exchanges to ensure corrections are made appropriately.

## **Create a Team Esprit de Corps**

Being on both the Producer and Reviewer end of peer reviews breaks down barriers and gives the team shared experiences. In addition, if properly trained and encouraged, the project team members each realize that finding defects, regardless if they are their own or someone else's, benefits the product and therefore the whole team.

---

### **PRACTICAL CONSIDERATIONS**

---

If your organization has not used a peer review process and you wish to do so, you will most likely be facing an initial wall of resistance that you will need to break through in order to be successful. If your developers have not had other people closely reviewing their work, particularly their code, they may find it an uncomfortable idea. They may not see the value in it, and will find reasons as to why they do not have the time to prepare for reviewing other people's work.

It is important to set the tone correctly right from the start. People need to understand that improving work products is the point, not trying to see who has the most (or least) defects in their work. Actually, sometimes a low number of defects found is more of a reflection on the quality of the Reviewers' efforts than the quality of the product reviewed. A cordial and cooperative atmosphere needs to be encouraged, and personal criticism cannot be allowed or it will poison the whole process. The first reviews may be a bit clumsy, and the number and type of defects found may be less than what you expect. But with experience things will get better. Make sure that check lists are developed and updated with the kinds of problems to look for. Once people sit on both sides of the reviewer/reviewed fence they will have empathy for each other. And when people see serious problems wrung out of their products long before they are built into them, they will see the value in doing peer reviews. In ELSYS we went from having to nearly twist some people's arms to get them to participate to a point where peer reviews are now part of our corporate culture. Now we often hear people ask, "When are we going to peer review that?"

If you have developers who are completely unwilling to participate in peer reviews with the proper attitude it is probably better to exclude them from the process at first. Get people with positive attitudes to pioneer your process. You will undoubtedly have some bugs in your processes that you'll need to iron out, so it is far better to include people who want to make the process work. Once you have a cadre of people who are reaping the benefits the word will get out. The naysayers will see their colleagues building better products with fewer problems, and that will encourage them to participate in the peer review process as well.

# Verification In CMMI Using Peer Reviews

AUTHORS: JEANNE BALSAM, JEAN SWANK LEE SHEINER, AND MARK PELLEGRINI

---

## SUMMARY

---

A peer reviews is a tool, but like any tool, the idea is to get more work out of it than you put into it. And if you don't know how to use the tool, or choose to use it incorrectly, your effort will be wasted.

Here are some things you should keep in mind when designing, implementing, and practicing a peer review process:

- The most important goal of a peer review is to find defects
- Keep managers out of peer reviews unless they have technical knowledge that is essential
- Keep peer review results confidential within the team to the greatest extent practical
- Remember that you are reviewing products, not the people who produced them
- Expect to find defects – nobody is perfect... nobody!
- Do not use peer review results to punish people
- Choose participants who have the expertise to be effective Reviewers
- Get a commitment from Reviewers to spend an appropriate amount of time preparing
- Schedule meetings to allow sufficient time for Reviewers to prepare
- Place any work product that is being reviewed under configuration control
- Keep peer review meetings under two hours in length. Schedule another session if needed
- Keep the meeting moving, and on topic
- For Structured Walkthroughs, provide a meeting room with facilities that support the review
- Provide Reviewers with any needed reference material
- Instruct Reviewers where to concentrate their examination, if appropriate to do so
- Identify defects in a peer review, don't fix them, unless special circumstances warrant it
- Make sure that all defects are recorded clearly and accurately
- Verify that all defects from a peer review are closed appropriately
- Maintain a cordial atmosphere during peer review meetings; do not tolerate personal criticisms
- Select an appropriate peer review type for the product being reviewed
- Peer review requirements before design begins; peer review designs before implementation
- Peer review, at a minimum, complex implementations and/or critical components
- Peer review test procedures
- Peer review critical-path items
- Foster an atmosphere where the team understands that finding defects is a good thing that benefits everyone.