

# A Brief Discussion on Technical Reviews and Audits

**Mr. Ram Srinivas**

Assistant Professor, Masters In Business Administration (General Management), Presidency University,  
Bangalore, India,  
Email Id-ramsrinivas@presidencyuniversity.in

## **ABSTRACT:**

The effectiveness and integrity of system engineering procedures are greatly dependent on technical reviews and audits. It is crucial to have reliable processes in place to evaluate system design, development, and implementation in the complex technological environment of today, when systems are getting more linked and sophisticated. The aim, advantages, and important factors of technical reviews and audits in system engineering are highlighted in this abstract, along with a general summary of their relevance. It describes the numerous reviews and audits that are often performed throughout the system engineering lifecycle, highlighting their unique goals and procedures. The paper also highlights important factors and recommended practises for carrying out efficient technical reviews and audits. It emphasises the need of having precise and well-defined review criteria, including stakeholders, and using the right tools and procedures. Additionally, it emphasises the need of timely and routine evaluations throughout the system engineering process to identify problems early and enable prompt remedial action. Additionally, the abstract highlights how technical reviews and audits include interdisciplinary teams made up of stakeholders, system engineers, subject matter experts, and external auditors. It emphasises the value of encouraging open dialogue, helpful criticism, and a culture of ongoing development throughout the review process.

## **KEYWORDS:**

Audits, Technical Evaluations, Quality Management, Technical Reviews.

## **I. INTRODUCTION**

Technical reviews and audits are crucial steps in the system engineering process since they serve to guarantee the efficacy, compliance, and high standards of a system's conception, development, and use. At different points of the system lifespan, these reviews and audits give critical assessments and evaluations, providing insightful analyses and suggestions for improvement. Technical reviews are formal assessments carried out by a group of specialists to evaluate the system's technical elements. They seek to confirm that the system complies with accepted criteria, norms, and best practices. Technical reviews are often carried out at significant project milestones or decision points, such as at the end of significant design stages or just before the production or implementation phase [1], [2].

The processes, methods, and documentation of the system are systematically and independently examined as part of audits, which check for compliance with predetermined criteria. Technical processes, configuration management, quality management, safety procedures, and regulatory compliance are just a few of the many topics that audits might examine. Beginning with a focus on the basic goals of technical reviews and audits which essentially entail determining whether a system's design and execution comply with accepted requirements, standards, and best practices the paper goes on to describe how technical reviews and audits work. It also emphasises how crucial it is for these activities to pinpoint possible dangers, weak points, and places for development. The next section of the abstract examines the various technical reviews and audits used in system engineering, including architectural reviews, design reviews, code reviews, and security audits. It highlights each review type's usefulness in evaluating various aspects of system functioning, performance, maintainability, and security by outlining the unique goals and domain of each kind of review [3], [4].

The following are the main goals of technical reviews and audits in system engineering:

**Analyse Compliance:** Technical studies and audits determine if the system's architecture, implementation, and operational procedures adhere to established standards, guidelines, and best practices. They provide remedial measures and assist in identifying any deviations or noncompliance [5], [6].

**Identify flaws and hazards:** Technical reviews and audits may identify flaws and hazards in the system's design, operations, or documentation via careful analysis. By reducing risks, addressing possible problems early, and assuring the system's overall quality and efficacy, these results assist.

**Provide Recommendations:** Technical reviews and audits make suggestions for improvement based on the results of the examination. These suggestions may include making changes to the design, improving the procedure, updating the documentation, or making other adjustments to guarantee improved performance, dependability, safety, and compliance [7], [8].

**Enhance Communication and Collaboration:** Technical reviews and audits provide stakeholders the chance to communicate and work together effectively. They provide a common understanding and alignment by bringing together experts and decision-makers to debate and examine the technical components of the system.

**Maintain Continuous Improvement:** Technical reviews and audits support a continuous improvement culture. Organisations may improve their system engineering practices and produce better products or systems by identifying areas that need improvement, correcting weaknesses, and putting suggestions into practice [9], [10].

To verify the quality, compliance, and effectiveness of a system, technical reviews and audits are crucial system engineering techniques. At various points of the system lifetime, they provide helpful evaluations, suggestions, and insights that promote the creation of strong, dependable, and high-performing systems.

## II. DISCUSSION

### Measurement of Progress

By evaluating the evolution of the design at significant event-driven points in the development schedule, the systems engineer may gauge the design's maturity and progress. To ascertain if the required degree of maturity has been attained, the design is compared to exit criteria that have been defined in advance for the specific event. Technical Reviews and Audits are the common names for these important occasions.

As it develops from an idea to a final product, a system goes through a series of phases. The term "levels of development" is used to describe this. After each stage of development, technical reviews are conducted to evaluate technical risk, assess design maturity, and decide whether to go on to the next stage. Technical Reviews simplify the transition to production and lower the risk of programmes by

1. Evaluating the design/development effort's maturity
2. Defining design specifications,
3. Making the design and associated procedures more difficult,
4. Verifying that the suggested design configuration complies with all technical specifications, client requests, and system requirements;
5. Assessing the system setup at various points,
6. Creating a space for collaboration, coordination, and integration across all academic fields and IPTs,
7. creating a baseline common configuration from which to go on to the next design level; and
8. Entering the decision database with the design choice's justification.

A series of technical interchange discussions that uncover and resolve difficulties, problems, and concerns precede formal technical evaluations. Problem resolution DOES NOT take place during the formal technical review; rather, it serves as a means of confirming that it has been done.

### Planning

Technical reviews need considerable, upfront, and early planning. The following are significant planning considerations:

1. Prompt and effective focus on and awareness of the review preparation tasks,
2. Determining and allocating the resources required to complete the whole review endeavour,
3. Customising in accordance with programme risk levels,
4. Scheduling that takes into account the availability of relevant data,
5. establishing criteria for admittance and departure based on events,

6. Conducting incremental evaluations as necessary,
7. IPT implementation,
8. An examination of all system operations;
9. Verification of the harmony and integration of all system components.

Along with their related end product, the maturity of supporting items is evaluated. Reviews should take into account how easily a system, subsystem, or configuration item can be tested, produced, trained for, and supported. The complexity of the system, subsystem, or configuration item under evaluation determines the review's depth. When design involves advancing cutting-edge technology, the assessment will need to go deeper than it would if it were for a commercially available item. Complex items or those involving the use of new technologies will need a closer examination. Create a checklist of the necessary during, and post-review actions. Create check lists for the design documentation's needed degree of information and exit criteria. Include the main inquiries that must be addressed and the data that must be accessible to aid the review process. The review process is shown in Figure 1 along with the essential actions.

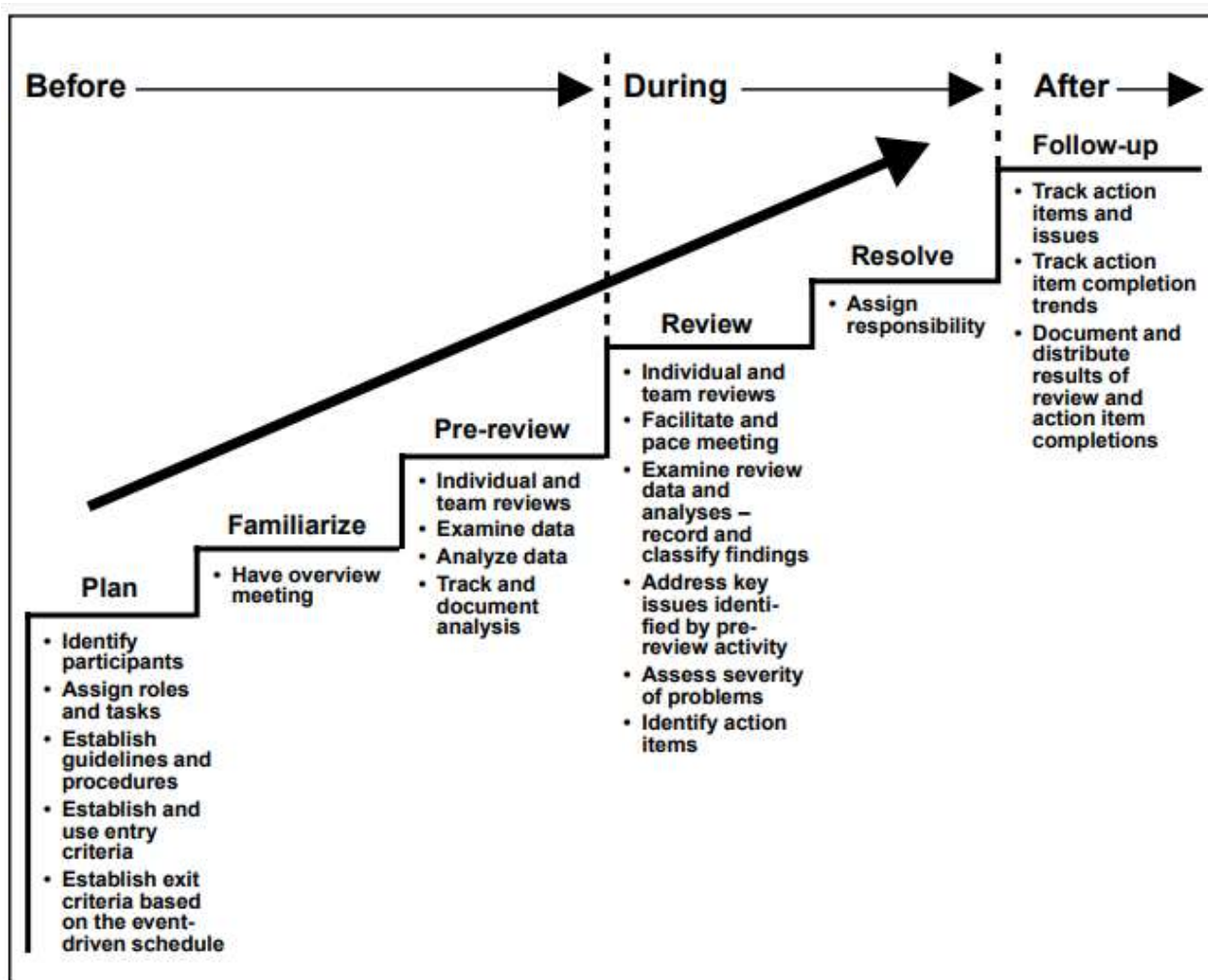


Figure 1: Technical Review Process [ocw.mit.edu].

### Technical evaluations

System-level and lower levels (such sub-system) technical evaluations are both carried out. The fundamental system-level reviews will be the main topic of discussion. Reviews at a lower level may be seen as activities that assist and get ready for system-level activities. It doesn't matter what evaluations are called; what matters is that they be conducted at the right moments in a program's development and that the contractor and the government have same expectations for their scope and results.

### Performing Reviews

Reviews are event-driven, which means they should be carried out whenever the evolution of the product justifies them. The validity of the evaluation will be compromised if it is forced (just because a timetable created before predicted the review at a certain time). Perform the task before the review occasion. Utilise the review event as

proof of finished work. Prior to the review, the data required to ascertain if the exit conditions are met should be circulated, examined, and the analysis should be coordinated. Specifications, drawings, manuals, schedules, design and test data, trade studies, risk analyses, effectiveness analyses, mock-ups, breadboards, in-process and finished hardware, test procedures, technical plans (Manufacturing, Test, Support, Training), and trend (metrics) data are the types of information required for a technical review. Reviews should be succinct and adhere to an agenda that has been developed based on the pre-review analysis and determination of what has to be addressed.

Only invited guests should be present in person. These people need to be those who assisted with the review's preparations and the IPT members in charge of ensuring that the event's exit requirements are met. There should be participation from all relevant government agencies, contractors, subcontractors, vendors, and suppliers among the participants. A review serves to validate a procedure. There shouldn't be any new things during the review. If material issues do surface, it is obvious that the review is being conducted too soon and that the project's risk has just gone up dramatically. A technical evaluation that was badly planned and executed is a big evidence of management issues. The review's follow-up actions are noted and kept track of. As quickly as feasible following the review, these items which are designated by precise nomenclature and due dates are created and disseminated. As tasks are finished, the outcomes of the action done are disseminated.

### Technical Reviews in Phases

A system often moves from one level of development to another, more sophisticated level of development as it advances through design and development. A typical system, for instance, might go from a stage where just the requirements were understood to one where a conceptual solution had been established. Alternately, it might go from a stage where the formal design requirements for the main subsystems are determined to one where the physical design solutions are specified. (See Figure 2)

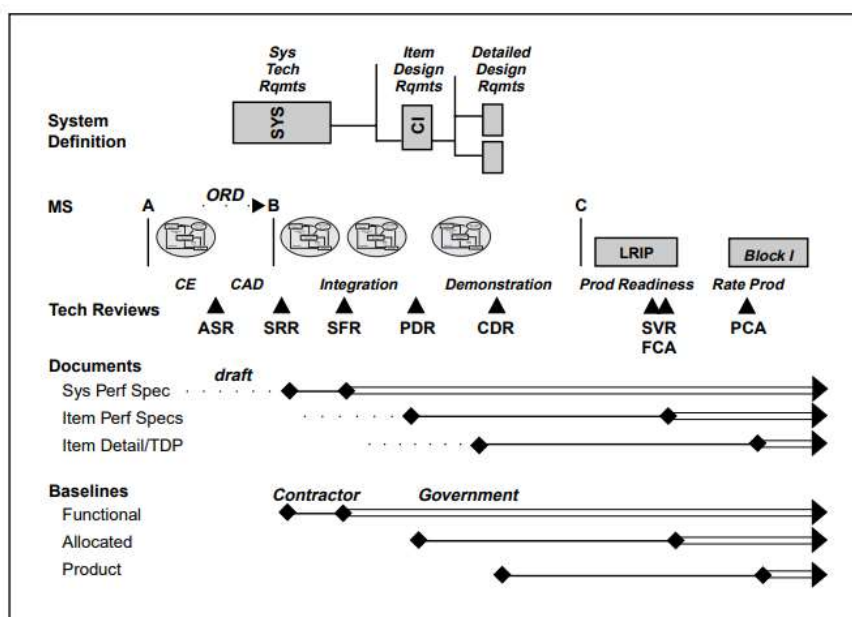
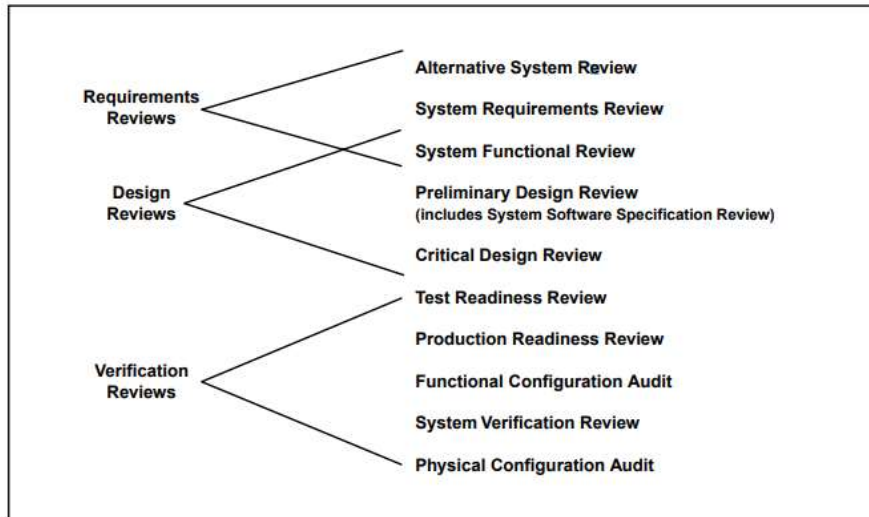


Figure2: Phasing of Technical Reviews [ocw.mit.edu].

The "levels of development" mentioned in this chapter correspond to these phases. Technical system assessments are often scheduled to coincide with the change from one stage of development to another. The technical review is the process by which the technical manager determines whether the system or item under review has reached a sufficient level of technical maturity to warrant advancement to the next stage of development and the corresponding resource commitment.

The emphasis of technical evaluation changes as the system or product moves further in its development. Defining the criteria that will serve as the foundation for later design and development activities is the process' first main emphasis. Similar to this, early technical assessments nearly always aim to make sure that the system definitions and top-level ideas accurately match the needs of the user. After system-level specification is finished, attention shifts to designing at the sub-system and lower levels. Technical evaluations take the form of design reviews during this time, which specify the design criteria before confirming that the physical solutions adhere to those requirements. Technical reviews and audits are carried out throughout the final phases of development to

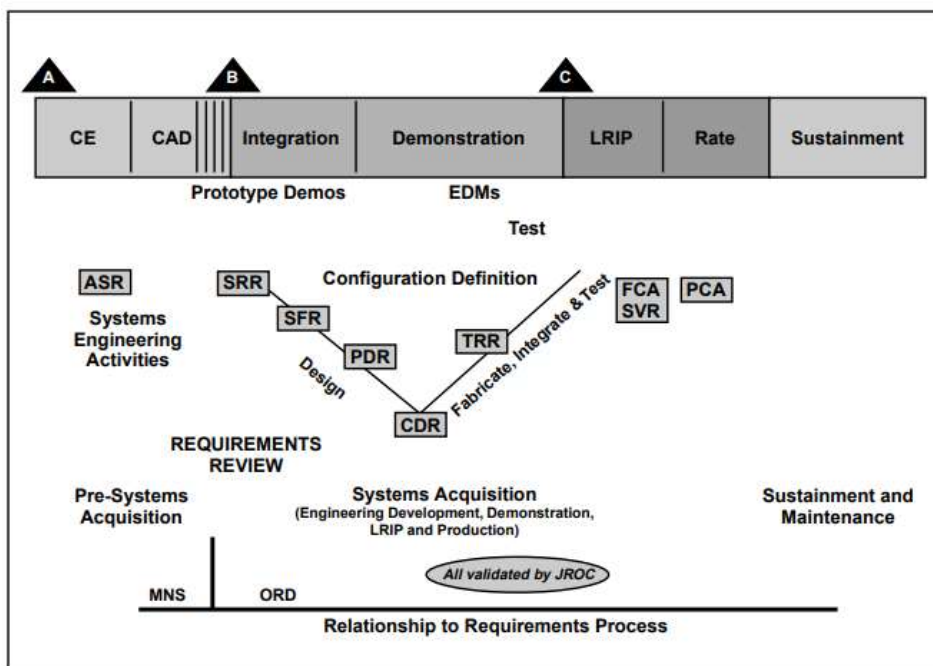
confirm that the produced items adhere to the specifications upon which the development is based. The normal timetable of system-level reviews is broken down by kind and topic in Figure 3.



**Figure 3: Typical System-Level Technical Reviews [ocw.mit.edu].**

The timing of technical reviews and other significant events that are often involved in carrying out the systems engineering process presents another challenge. These activities typically take place in relation to different stages of the DoD acquisition life-cycle process. Based on the explicit and specific requirements of the circumstance, the timing of these events will vary somewhat from programme to programme; nonetheless, Figure 4 illustrates a generalised idea of how the technical reviews typical of systems engineering may occur related to the acquisition life-cycle stages.

Numerous names for specific system-level technical reviews exist, and various engineering standards and papers often use different terminology to refer to the same study. The nomenclature by which technical reviews are referred to are not crucial; what matters is that you understand the schedule of reviews that is typical for system development and what their main objectives are. The schedule of evaluations that is presented in the following sections is full in terms of evaluating technological advancement from idea to production. The names were picked because they seemed to describe the activity's main objective. Not all programmes should intend to undertake all of the following reviews, since the variety of reviews and the precise emphasis of each review must be adapted to the unique requirements of the programme being developed.



**Figure 4: Relationship of Systems Engineering Events to Acquisition Life Cycle Phases [ocw.mit.edu].**



### III. CONCLUSION

Technical reviews and audits provide a systematic and thorough examination of the system's design, execution, and compliance with requirements, which is why they are so important in system engineering. These evaluations and audits assist in ensuring that the system achieves its goals, works as intended, and satisfies quality and performance criteria. Throughout the system's lifespan, technical reviews are carried out at several points, including during requirement analysis, design, implementation, and testing. They include a careful analysis of the system's documentation, design artefacts, and advancement in comparison to predetermined standards. Technical evaluations assist in identifying any possible faults, contradictions, or holes in the system's design and execution, enabling early discovery and problem-solving. In conclusion, technical audits and reviews are crucial steps in the system engineering process. They make sure that the system's requirements compliance, design, and implementation have all been carefully examined and confirmed. System engineers may find and fix possible problems, raise system quality, and make sure the system achieves its goals by carrying out these evaluations and audits

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