



17. Fabrication, Assembly, and Testing

NASA ESMD Capstone Design

developed by

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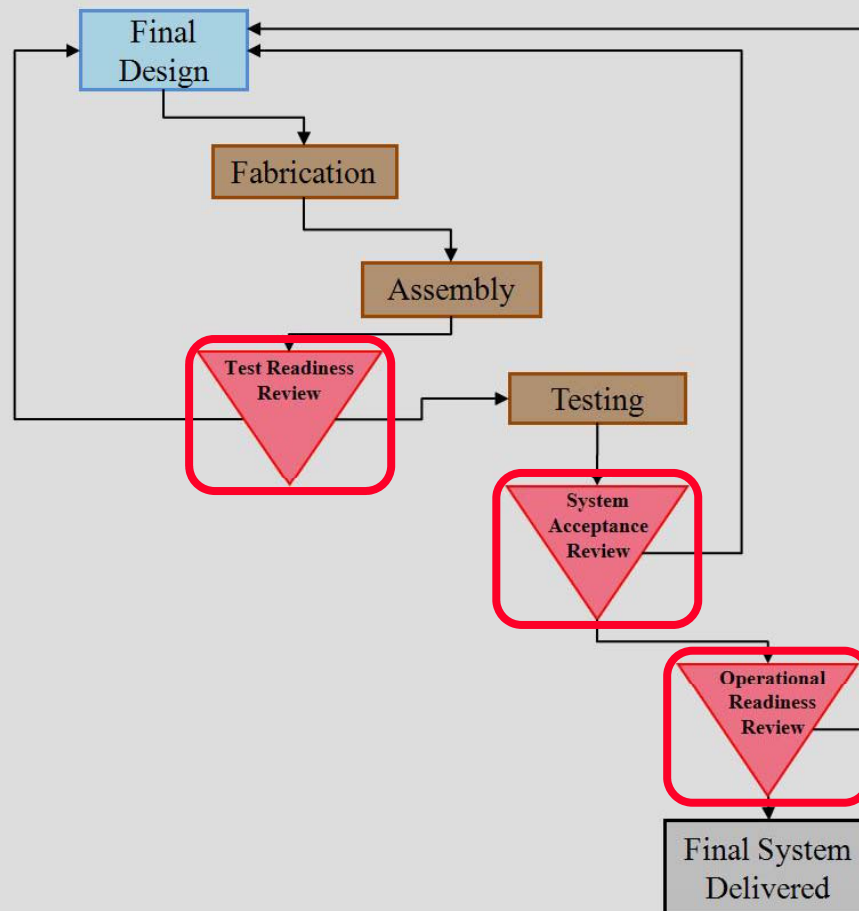
MICHIGAN TECHNOLOGICAL UNIVERSITY

and

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Where in the process?



Phase D: Fabrication, Assembly, and Testing

Project Tools Covered

- ◆ Test Readiness Review (TRR)
 - Carry out to ensure that the test article, test facility, support personnel, and test procedures are ready for testing.
- ◆ System Acceptance Review (SAR)
 - Carry out to examine the system, its end products and documentation, and test data and analyses that support verification.
- ◆ Operational Readiness Review (ORR)
 - Carry out to examine the actual system characteristics to make sure that they accurately reflect the deployed state of the system.

Test Readiness Review (TRR)

What?

- ◆ Ensures that the test article, test facility, support personnel, and test procedures are ready for testing and data acquisition, reduction, and control

When?

- ◆ Held prior to commencement of verification and validation testing

(NASA Systems Engineering Handbook, SP 2007)

Test Readiness Review (TRR)

- ◆ Results of the review
 - Signifies that the test and safety engineers have certified that preparations are complete, and that the project manager has authorized formal test initiation

(NASA Systems Engineering Handbook, SP 2007)

Entrance and Success Criteria

TRR Entrance and Success Criteria	
Test Readiness Review	
Entrance Criteria	Success Criteria
<ol style="list-style-type: none"> 1. The objectives of the testing have been clearly defined and documented and all of the test plans, procedures, environment, and the configuration of the test item(s) support those objectives. 2. Configuration of the system under test has been defined and agreed to. All interfaces have been placed under configuration management or have been defined in accordance with an agreed-to plan, and a version description document has been made available to TRR participants prior to the review. 3. All applicable functional, unit-level, subsystem, system, and qualification testing has been conducted successfully. 4. All TRR-specific materials such as test plans, test cases, and procedures have been made available to all participants prior to conducting the review. 5. All known system discrepancies have been identified and disposed in accordance with an agreed-upon plan. 6. All previous design review success criteria and key issues have been satisfied in accordance with an agreed-upon plan. 7. All required test resources people (including a designated test director), facilities, test articles, test instrumentation, and other enabling products have been identified and are available to support required tests. 8. Roles and responsibilities of all test participants are defined and agreed to. 9. Test contingency planning has been accomplished, and all personnel have been trained. 	<ol style="list-style-type: none"> 1. Adequate test plans are completed and approved for the system under test. 2. Adequate identification and coordination of required test resources are completed. 3. Previous component, subsystem, and system test results form a satisfactory basis for proceeding into planned tests. 4. Risk level is identified and accepted by program/competency leadership as required. 5. Plans to capture any lessons learned from the test program are documented. 6. The objectives of the testing have been clearly defined and documented, and the review of all the test plans, as well as the procedures, environment, and the configuration of the test item, provide a reasonable expectation that the objectives will be met. 7. The test cases have been reviewed and analyzed for expected results, and the results are consistent with the test plans and objectives. 8. Test personnel have received appropriate training in test operation and safety procedures.

(NASA Systems Engineering Handbook, SP 2007)

System Acceptance Review (SAR)

What?

- ◆ Verifies the completeness of the specific end products in relation to their expected maturity level and
- ◆ Assesses compliance to stakeholder expectations
- ◆ SAR examines the system, its end products and documentation, and test data and analyses that support verification
- ◆ Ensures that the system has sufficient technical maturity to authorize its shipment to the designated operational facility or launch site

(NASA Systems Engineering Handbook, SP 2007)

System Acceptance Review (SAR)

When?

- ◆ Conducted during the end of Phase D before the Operational Readiness Review
- ◆ Results of the review
 - System is accepted by the buyer, and authorization is given to ship the hardware to the launch site or operational facility
 - Authorization to install software and hardware for operational use

(NASA Systems Engineering Handbook, SP 2007)

Entrance and Success Criteria

SAR Entrance and Success Criteria	
System Acceptance Review	
Entrance Criteria	Success Criteria
<ol style="list-style-type: none"> 1. A preliminary agenda has been coordinated (nominally) prior to the SAR. 2. The following SAR technical products have been made available to the cognizant participants prior to the review: <ol style="list-style-type: none"> a. results of the SARs conducted at the major suppliers; b. transition to production and/or manufacturing plan; c. product verification results; d. product validation results; e. documentation that the delivered system complies with the established acceptance criteria; f. documentation that the system will perform properly in the expected operational environment; g. technical data package updated to include all test results; h. certification package; i. updated risk assessment and mitigation; j. successfully completed previous milestone reviews; and k. remaining liens or unclosed actions and plans for closure. 	<ol style="list-style-type: none"> 1. Required tests and analyses are complete and indicate that the system will perform properly in the expected operational environment. 2. Risks are known and manageable. 3. System meets the established acceptance criteria. 4. Required safe shipping, handling, checkout, and operational plans and procedures are complete and ready for use. 5. Technical data package is complete and reflects the delivered system. 6. All applicable lessons learned for organizational improvement and system operations are captured.

(NASA Systems Engineering Handbook, SP 2007)

Operational Readiness Review (ORR)

What?

- ◆ Examines the actual system characteristics and the procedures used in the system or end product's operation and ensures that all system and support hardware, software, personnel, procedures and user documentation accurately reflect the deployed state of the system

When?

- ◆ Carried out at the end of Phase D before the end product is ready for field operation

(NASA Systems Engineering Handbook, SP 2007)

Operational Readiness Review (ORR)

- ◆ Results of the review
 - As a result of the successful completion of ORR, the system is ready to assume normal operations

(NASA Systems Engineering Handbook, SP 2007)

Entrance and Success Criteria

ORR Entrance and Success Criteria	
Operational Readiness Review	
Entrance Criteria	Success Criteria
<ol style="list-style-type: none"> 1. All validation testing has been completed. 2. Test failures and anomalies from validation testing have been resolved and the results incorporated into all supporting and enabling operational products. 3. All operational supporting and enabling products (e.g., facilities, equipment, documents, updated databases) that are necessary for the nominal and contingency operations have been tested and delivered/installed at the site(s) necessary to support operations. 4. Operations handbook has been approved. 5. Training has been provided to the users and operators on the correct operational procedures for the system. 6. Operational contingency planning has been accomplished, and all personnel have been trained. 	<ol style="list-style-type: none"> 1. The system, including any enabling products, is determined to be ready to be placed in an operational status. 2. All applicable lessons learned for organizational improvement and systems operations have been captured. 3. All waivers and anomalies have been closed. 4. Systems hardware, software, personnel, and procedures are in place to support operations.

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