1. Purpose

This guide discusses the Space Launch Delta 30 implementation of Range Commanders Council (RCC) 319, Flight Termination Systems (FTS) Commonality Standard. It also provides comparison to the Federal Aviation Administration (FAA) FTS requirements, identifying similarity and commonality. The following guide is presented for the benefit of Range Users to facilitate understanding of RCC 319 and to foster a close working relationship with the Space Launch Delta 30 Safety office.

The guide is structured as follows:

2. Requirements Philosophy[1]

Launch vehicles are typically unique and are produced in very limited quantities. Launching such a complex and unique system presents an unsatisfactory risk to the people and nearby property. Therefore, a rigorous and highly reliable flight safety system is inherently required during launch.

An example of the importance of a flight safety system is Mission TDT-01. On 15 June 1993, a Minuteman I inert test Inter-Continental Ballistic Missile (ICBM) launched out of LF-03 at Vandenberg AFB and experienced issues.[2] The second the missile exited the silo it became apparent the missile was heading the opposite direction of the planned trajectory and headed towards population centers. The flight control officers and forward observers were aware and at the ready and were able to activate the flight termination system on the vehicle to destroy itself. The mission was famously nicknamed the "Casmalia Express" due to its obvious attempt to fly directly towards the nearby town of Casmalia, located north of Vandenberg AFB. Although the debris started a large wildfire on the base, no injuries or property damage were caused by this anomaly because of the flight termination system's reliability and the speed of the flight controllers.

As designated representatives of the Eastern and Western Range Space Launch Delta Commander, the Safety Offices assure that the public, launch site personnel, and public resources are protected from the inherent hazards of launch vehicles and payloads. Range Safety[3] depends on a highly reliable flight safety system to ensure safety of airborne launch vehicles. Reliability is assured through rigorous design, test, validation, and iteration.

Range Safety works closely with the Range Users from the time a program is first introduced. Range Safety strives to maintain the maximum flexibility in the methods used to achieve the ultimate safety objectives, while not imposing undue or overly restrictive requirements on the Range User. All Range User proposals for meeting the safety objectives receive careful consideration. Early and continuous coordination between Range Users and Range Safety is a key success factor in this partnership.[3]

1. AFSPCMAN 91-710 Implementation Guide, SEAL-SSD-001. 2021
2. Minuteman: A Technical History of the Missile that Defined American Nuclear Warfare. 2020
3. Range User Handbook, EWR 127-1. 1995.

3. RCC 319 FTS Requirements[4]

To protect the public, the launch site, and government resources, the US Space Force has developed RCC 319 which was developed from a series of earlier FTS requirements, and primarily, its predecessor EWR 127-1, Eastern Western Range Safety Requirements. RCC 319 represents a compilation of development and test criteria derived from lessons learned over decades of space launch missions. It also consolidates other military, government, and consensus standards, sometimes paraphrased, in order to minimize cross-referencing standards.

RCC 319 codifies the Space Force's FTS criteria. It defines requirements in order to best manage how the design, manufacture, test, and operate FTS components to ensure positive control of a vehicle can be maintained at all times. The set of requirements specified in the RCC 319 permit the Range User to benefit from lessons learned and distilled requirements sources, so as not to have to develop their own set of compliance requirements.

3.1. RCC 319 Document Layout

The following section provides brief descriptions of RCC 319.

<u>RCC 319 Chapter 1</u>, Introduction

Chapter 1 describes the overview of the document and defines authorities and responsibility. This chapter presents policies and discusses the approval processes from the convening range authority. Chapter 1 outlines specific aspects of what an FTS should accomplish. It also includes information on Waivers and ELSs, Tailoring, grandfathering, and FTS operational constraints.

Note: the identification of ELS or Waivers can only be addressed during, or after the requirements tailoring process has been completed (see 3.3, below). At this point the user compares requirements to design and processing, reviews safety analysis, identifies incongruities and informs the Range Safety office.

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4. Description of the Air Force requirements is based on independent assessment consensus study report performed by the National Research Council: Streamlining Space Launch Range Safety. 2000

RCC 319 Chapter 2, Tailoring

Chapter 2 specifies the properties of a tailored RCC 319. The chapter defines the capability and process for how a range user should go about tailoring the document.

RCC 319 Chapter 3, Common FTS and Component Performance Requirements

Chapter 3 identifies common vehicle and component requirements and groups them together on those bases. The chapter gives requirements for a command termination system and autonomous flight termination system. The chapter is broken into sections with requirements for each component or aspect of an FTS.

The components or aspects addressed in this chapter include:

- FTS Functional Requirements
- FTS Design
- Environmental Design
- Command Termination System
- Automatic, Inadvertent-Separation, Fail-Safe, or AFTS
- FTS Safing and Arming Devices
- Liquid-Propellant Shutdown
- FTS Monitoring
- FTS Electrical Components and Electronic Circuitry
- FTS Monitor, Checkout, and Control Circuits
- FTS Ordnance Path
- Radio Frequency Receiving System
- FTR
- Wiring and Connectors
- Laser-Initiated Ordnance Fiber-Optic Cable Assembly
- Batteries
- Electromechanical Safe-and-Arm Devices with a Low-Voltage Initiator
- High-Energy Electronic Initiator Firing Unit
- Laser Firing Unit
- Ordnance Interrupter
- Ordnance Initiators
- Devices Containing Percussion Initiators
- Propellant-Actuated Devices/Cartridge-Actuated Devices

- Explosive Transfer System
- Destruct/Terminate Charge
- Parachute Systems
- FTS Shutdown Valves
- Vibration and Shock Isolators
- Autonomous Flight Termination Unit
- Miscellaneous Components

RCC 319 Chapter 4, FTS Component Test and Analysis Requirements

Chapter 4 focuses on the testing and analysis of FTS components. The chapter is separated by component and each component is separated by test. Tables of required test values for each component are given along with relevant components.

The test topics discussed in this chapter include:

- Scope and Compliance
- Component Tests and Analyses
- Test Plans and Procedures
- Test Anomalies and Failures
- Failure Analysis
- Test Tolerances
- Test Equipment
- Rework and Repair of Components
- Test and Analysis Reports
- Component Test and Analysis Tables
- Component Examination
- Acceptance Testing and Analysis
- General Qualification Testing and Analysis Requirements
- Qualification Non-Operating Environments
- Qualification Operating Environments
- Radio Frequency Receiving System
- FTR - Analog/Tone-Based
- EFTR
- Autonomous Flight Termination Unit
- FTS Shutdown Valves
- Miscellaneous Components

- Electrical Connectors and Harnesses
- Remotely Activated Silver-Zinc Batteries
- Thermal Batteries
- Manually Activated Silver-Zinc Batteries
- Nickel-Cadmium Batteries
- Lithium-Ion Batteries
- Lead-Acid Batteries
- Safe-and-Arm Devices, Low-Voltage Initiators, Rotor Leads, and Booster Charges
- High-Energy Firing Units
- LFUs, Fiber-Optic Cable Energy Transfer Systems, and LIDs
- Ordnance Interrupters
- Percussion-Initiated Device
- Explosive Transfer System, Ordnance Manifolds, and Destruct Charges
- Ordnance Interfaces and Manifold Qualification
- Shock and Vibration Isolators

RCC 319 Chapter 5, FTS Component, Subsystem, and System Pre-Launch Test and Launch Requirements

Chapter 5 expands upon the tests that are done pre-launch. These are tests done with the FTS components installed on the vehicle in flight-like configuration. These tests include small subsystems and overall system tests including the FTS end-to-end test to finally verify the systems performance close to launch.

RCC 319 Chapter 6, FTS Ground Support and Monitoring Equipment Design Requirements

Chapter 6 discusses ground support equipment (GSE) that is required for the FTS to function. The chapter mostly deals with ordnance simulators, safety consoles, and test equipment.

RCC 319 Chapter 7, FTS Analysis

Chapter 7 includes analyses required in the Flight Termination System Report (FTSR). These analyses prove the integrity of the FTS in flight configuration.

RCC 319 Chapter 8, Documentation

Chapter 8 includes all required documentation that is required for the range to approve the launch. The documentation discussed is the FTSR, as it includes all the important notifications to the range regarding FTS.

RCC 319 Appendix A, Safety Software Requirements

Appendix A includes a stand-alone set of requirements for flight safety software certification. The chapter also includes IV&V requirements for safety software and requirements for partitioned and non-partitioned systems.

RCC 319 Appendix B, Electronic Piece-Part Procurement Requirements

Appendix B discusses in detail how to acquire electronic components required for FTS. This chapter includes testing done on parts to ensure quality and acceptance.

RCC 319 Appendix C, Electronic Piece-Part Derating Requirements

Appendix C discusses in detail how to derate electronic components for each type of component. The chapter is sorted by component and gives testing requirements and references military standards to use to derate electronic components.

The components or aspects discussed in this chapter are:

- General
- Capacitors
- Connectors Reliability Application Derating Guidelines
- Crystal Reliability Application Derating Guidelines
- Diode Reliability Application Derating Guidelines
- Electromagnetic Interference Filters - Reliability Application Derating Guidelines
- Fuses - Reliability Application Derating Guidelines
- Inductor and Transformer Reliability Application Derating Guidelines
- Integrated Circuits
- Motors - Derating Criteria
- Printed Wiring Boards and Printed Circuit Boards
- Relays Derating Criteria
- Resistors
- Slip Rings - Derating Criteria

- Substrates - Derating Criteria
- Switches - Derating Criteria
- Transistors - Derating Criteria
- Wire and Cable - Derating Criteria

RCC 319 Appendix D, Planning and Executing a Successful FTS Acquisition using RCC 319

Appendix D discusses the optimal route a range user should take to ensure compliant and operational FTS. It describes the planning and execution of the design to ensure FTS certification. Flow diagrams are used to show ideal processes and procedures on how to develop an FTS.

RCC 319 Appendix E, Glossary

Appendix E includes a glossary with important terms and their definition.

RCC 319 Appendix F, Citations

Appendix F includes a list of citations that are used throughout the document.

RCC 319 Appendix G, References

Appendix F includes references to documents where the requirements and lessons learned in RCC 319 or derivative from.

3.2. Tailoring of Requirements

Due to the unique and varied nature of Space Systems, and the fact that they often encompass evolving technologies, a rigid and uncompromising safety standard may not be appropriate. While the safety objectives must be accomplished, it is not the intent of the Safety Office to impede emerging technological advances, nor to place an unreasonable burden upon the Range User. The resolution to this dilemma is tailoring of the safety requirements, which provides Range Users with added flexibility.

Tailoring is performed by representatives from the Range User, the Safety Office(s), and the FAA/AST, if appropriate. This team is referred to as the High-Performance Work Team (HPWT). Tailoring is typically accomplished using a three-column matrix format (Original Requirement/ New Text/ Rationale).

Tailoring may encompass all of the following:

- Deletion of requirements which are not applicable.
- Modification of requirements to accommodate the unique nature of the specific program, so long as an EQUIVALENT LEVEL OF SAFETY (ELS) is achieved.
- Addition of information addressing safety issues not covered in the original requirement.
- Use of text from Range User controlled command media that addresses/controls how Range User meets the requirement.

Rationale for each tailored item is an integral part of the process.

Tailoring of the Safety requirements is strongly encouraged as mutually beneficial to both the user and Range Safety. It also provides a means of assessing Range User program requirements against historical lessons learned.

Tailoring is conducted under the guidance found in Chapter 1 and 2 of RCC 319. Specific details are included in Chapter 2.

3.3. Equivalent Level of Safety and Waivers

During the tailoring process the ELS determinations for the tailoring may be provided and approved through the tailoring change process. This is usually accomplished through evaluation of safety analysis, or technical rationale determining that the intent of the requirement is met, within the general design inhibit requirements set forth by RCC 319. The final approved tailored edition shall be placed on the Range User's contract or applied through a Commercial Space Operations Support Agreement. Depending on the relationship to public safety, the approval is granted by either the SLD/CC, the Chief of Safety, or the Safety section chief.

The HPWT cannot provide or approve waivers.

Definition: equivalent level of safety—an approximately equal level of safety; may involve a change to the level of expected risk that is not statistically or mathematically significant as determined by qualitative or quantitative risk analysis; equivalent level of safety replaces the former "meets intent" certification process.

After the tailoring process is complete. Any changes, deletions or non-compliances are handled on an individual basis through a formal documentation, review, and approval process.

4. Correlation of RCC 319 and FAA Requirements

The Federal Aviation Administration (FAA), in support of commercial programs, implements similar FTS requirements as the RCC. The current relevant FAA regulations are 14 CFR Part 450 Launch and Reentry License Requirements. Programs currently licensed under parts 417 or 431 are required to show compliance with Part 450 no later than March 10, 2026.[5]

Under 14 CFR 450, flight safety system requirements are defined in 450.108(b):

> An operator must use a flight safety system that:
>
> > (1) Meets the requirements of § 450.145 if the consequence of any reasonably foreseeable failure mode in any significant period of flight is greater than 1×10^{-2} conditional expected casualties in uncontrolled areas; or
> >
> > (2) Meets the requirements of § 450.143 if the consequence of any reasonably foreseeable failure mode in any significant period of flight is between 1×10^{-2} and 1×10^{-3} conditional expected casualties for uncontrolled areas.

450.145 contains requirements for a highly reliable flight safety system as required per 450.108(b)(1). The requirements of 450.145 are satisfied through a Means of Compliance (MOC) that must be accepted by the FAA Administrator. An Advisory Circular (AC) to 450.108 provides guidance to meet these requirements and identifies RCC 319 as one acceptable MOC to satisfy 450.145.[6]

450.143 contains requirements for safety-critical systems, excluding highly reliable flight safety systems, as required per 450.108(b)(2). Historically, the FAA has found that operations launching or reentering in remote locations or for stages that only overfly sparsely populated regions have a CEc between 1×10^{-2} and 1×10^{-3}. Additional guidance can be found in AC 450.143-1, once published by the FAA.

5. FAA Rule 450 Final. September 20, 2020
6. AC No. 450.108-1 Flight Abort Rule Development. July 27, 2021

5. Correlation of RCC 319 and SSCMAN 91-710

The Space Systems Command (SSC), in support of commercial launch programs, implements some additions and references to the FTS requirements found in RCC 319. SSCMAN 91-170 Volume 4 pertains to FTS and are subject to compliance for range users at the eastern and western ranges. The volume relies heavily on referencing both RCC 319 and RCC 324 to meet compliance for FTS. Volume 4 also offers some added requirements specific to the eastern and/or western ranges that are relevant for users to certify their FTS for operation.

6. Flight Termination System Engineering SLD 30/SEAE

The flight termination systems engineering function is performed by the Space Launch Delta, FTS Safety Engineering office (SLD 30/SEAE). Specific questions (formal or informal) about the RCC 319 Flight Termination Systems Requirements, or this document can be addressed to this office. Please contact your XP point of contact and they will provide further contact information for SLD 30/SEAE.

RCC 319 Flight Termination Systems Requirements can be accessed at:

https://www.trmc.osd.mil/wiki/display/publicRCC >> 3 – Online Publications and Standards >> 300s Standards >> 319 Flight Termination Commonality Standard

Appendix D

Planning and Executing a Successful FTS Acquisition using RCC 319

D.1 Purpose

This is a guide to help range users understand the steps necessary for developing an acceptable FTS at any MRTFB. Development of FTS has stringent design, test, data, and reliability requirements that must be met in order to test on any participating range. The flow charts in this document are built to:

- Help the range user and contractor understand all FTS requirements early such that stakeholders can allocate sufficient time and money to the development;
- Illustrate milestone entry/exit criteria using the relationships between data items;
- Expedite document reviews by illustrating document dependencies;
- Help stakeholders identify an FTS acquisition's critical path through each stage.

This guide does not negate or supersede range-specific certification processes.

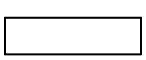
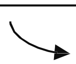
D.2 Milestones

Milestones of FTS development and the related figures are shown in Table D-1. Symbols and descriptions used in the figures are shown in Table D-2.

Table D-1. FTS Development Milestones

Milestone (Page)	Process (Page)
Contract Obligation	Figure D-1
System-level PDR with Range User or their Prime Contractor	Figure D-2
Flow of Requirements to Sub-Contractors	Figure D-3
Individual PDR(s) for each New Component	Figure D-4
Individual CDR(s) for each New Component	Figure D-4
System-level CDR with Range User or their Prime Contractor	Figure D-5
FTS Certification/Mission Support	Figure D-6

Table D-2. Figure Legend

Symbol	Description	Meaning
	Rectangle with solid border	Data items to develop are defined by text inside box with links to descriptions of what each data item contains
	Orange diamond	Review of item by RSOs (schedule 30 calendar days for review unless otherwise indicated in the document description)
	Black solid line with arrow	Indicates completion of a task and indicates the next task

	Red dashed line with arrow	Indicates submitted items must be re-worked to address comments from the RSOs

D.3 FTS Development Flow Charts

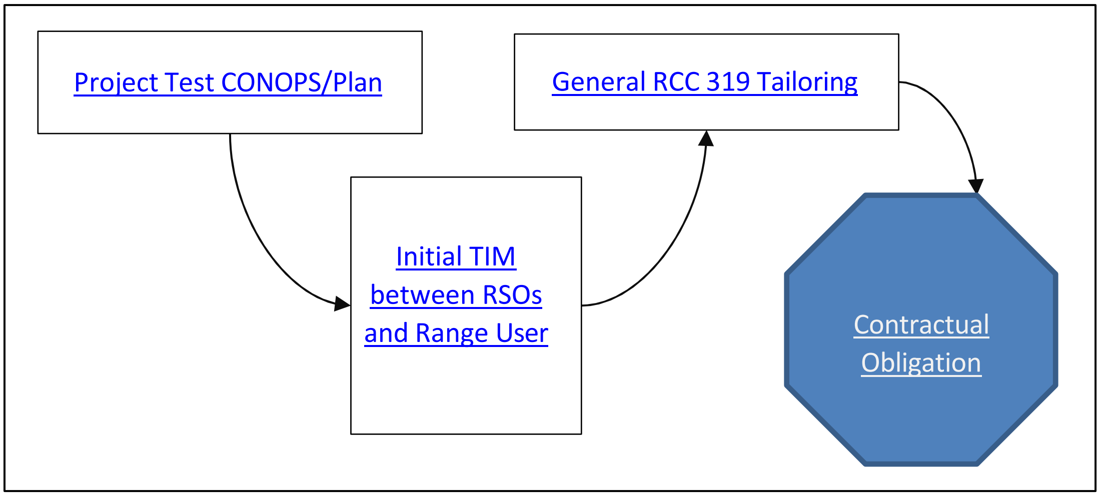


Figure D-1. Work Prior to Contractual Obligation

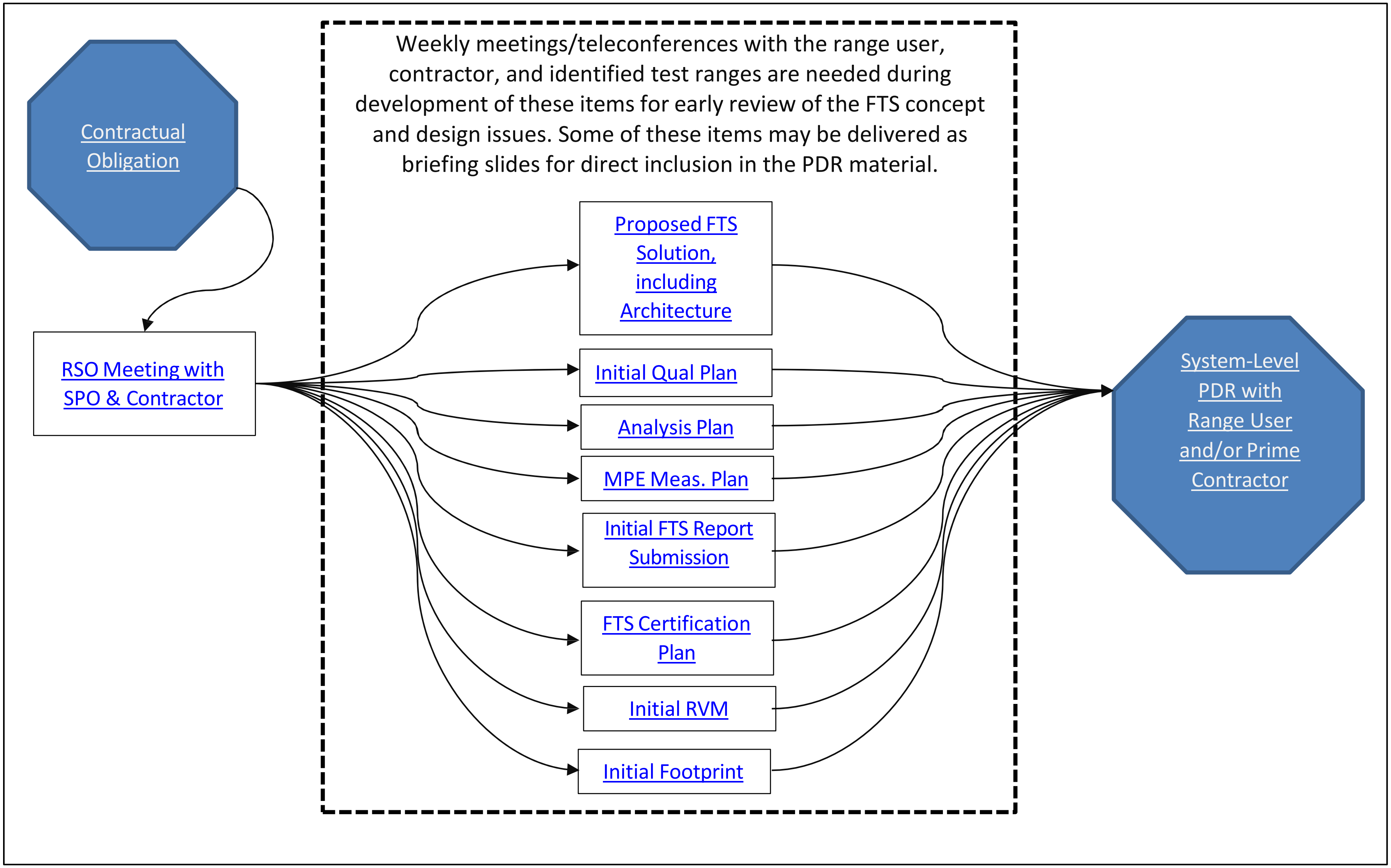


Figure D-2. Entry Criteria for the System-Level PDR

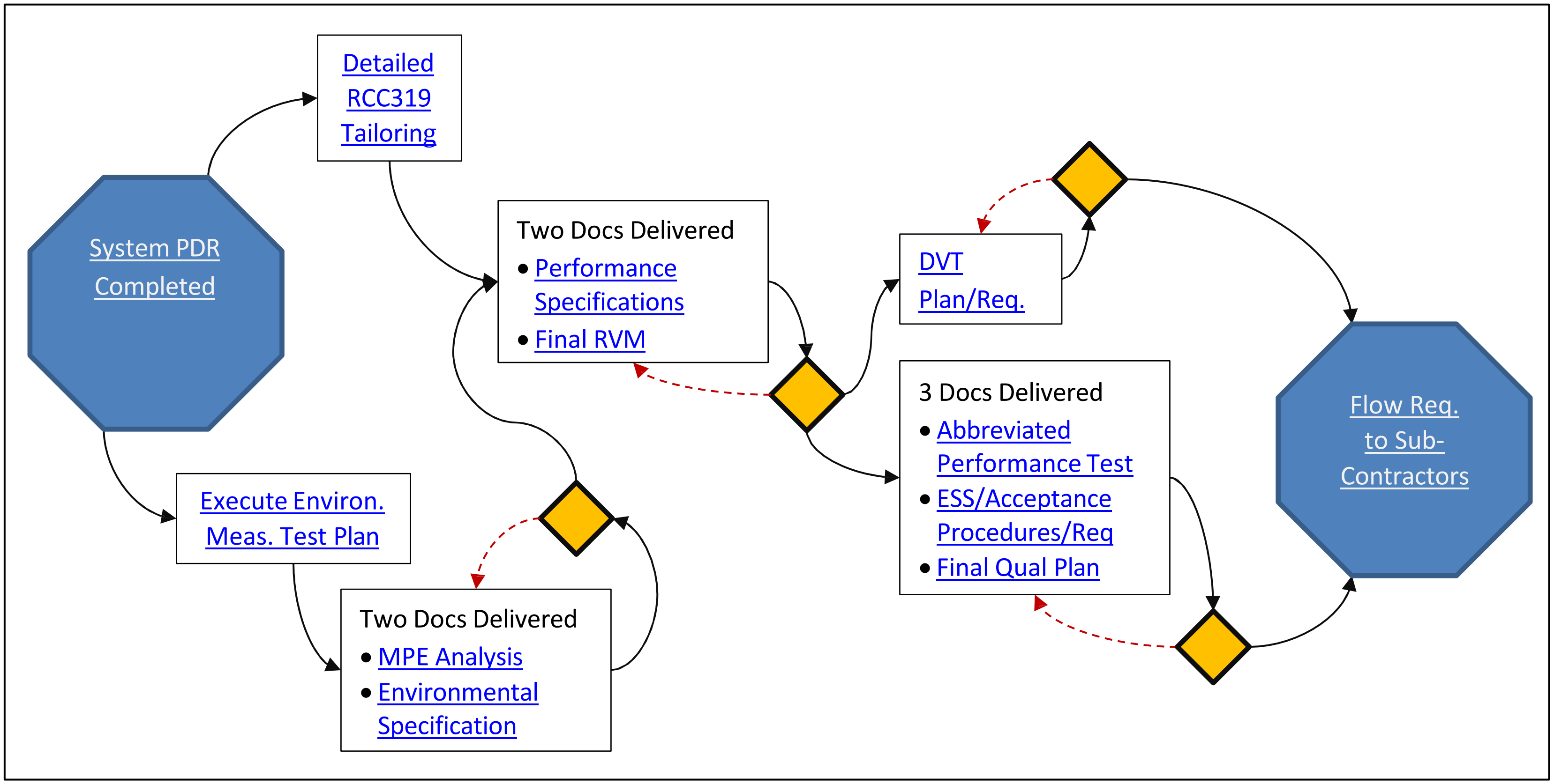


Figure D-3. Criteria to Flow Requirements to Subcontractors

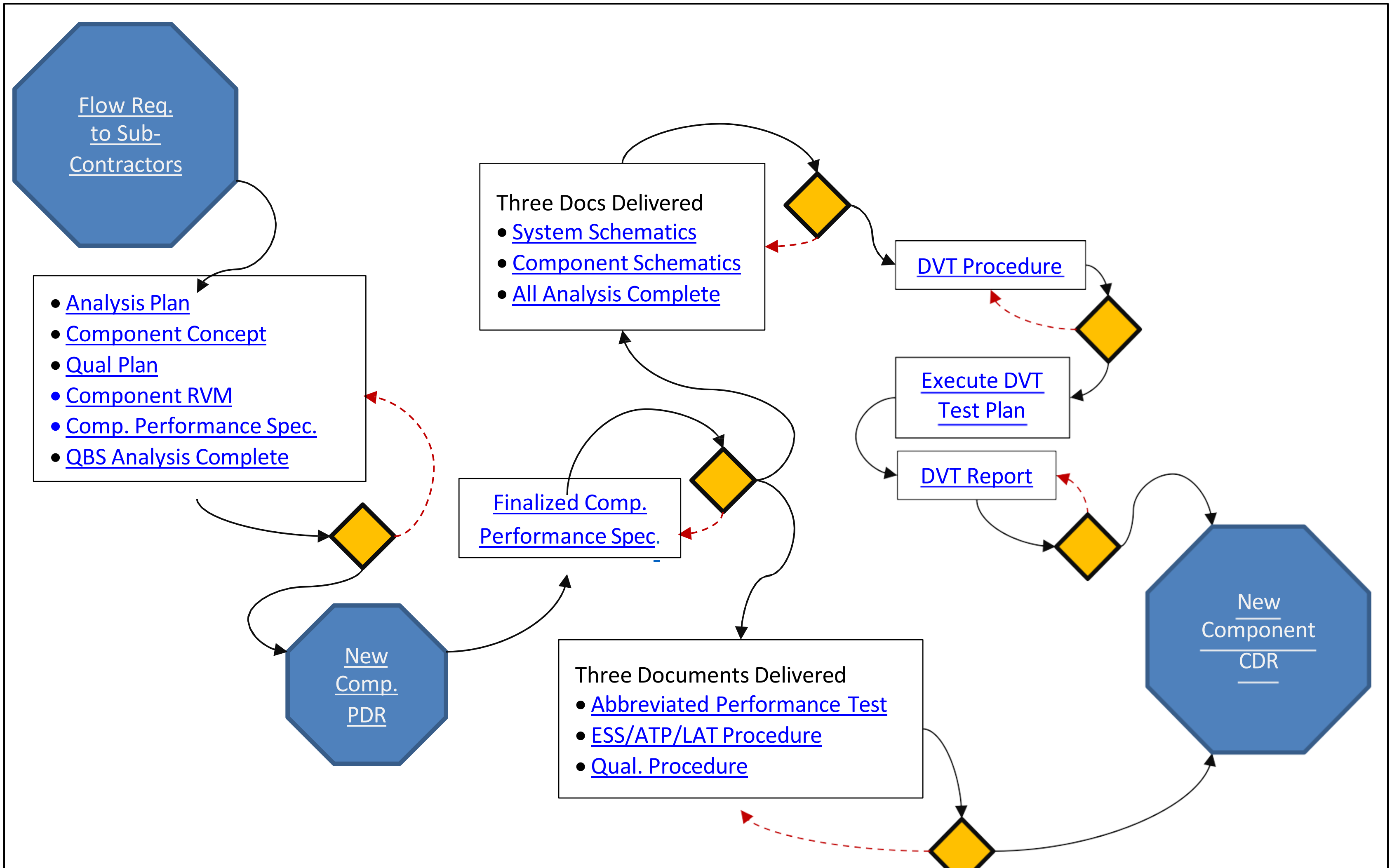


Figure D-4. New Component PDR(s) and CDR(s)

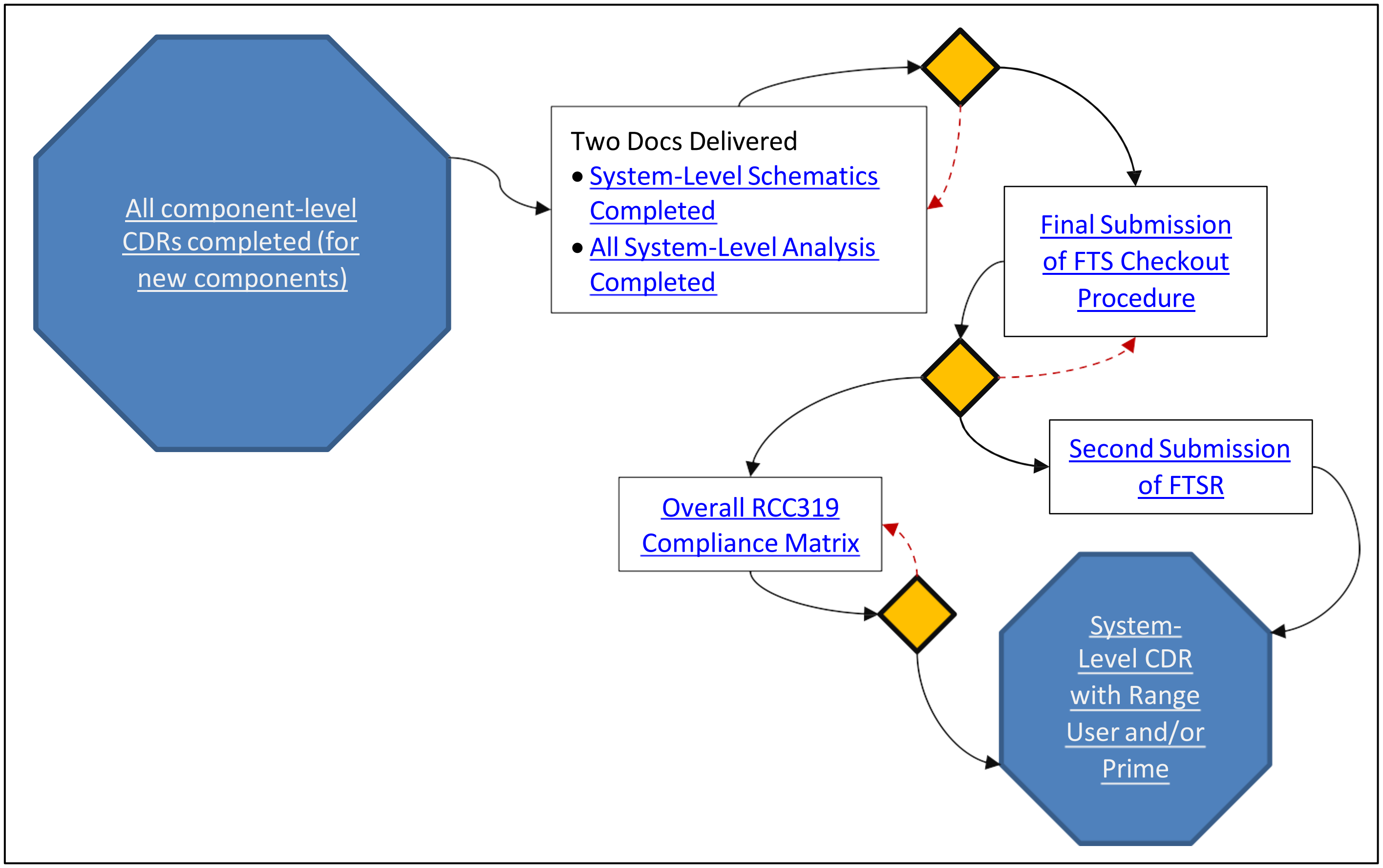


Figure D-5. Entry Criteria for the System-Level CDR

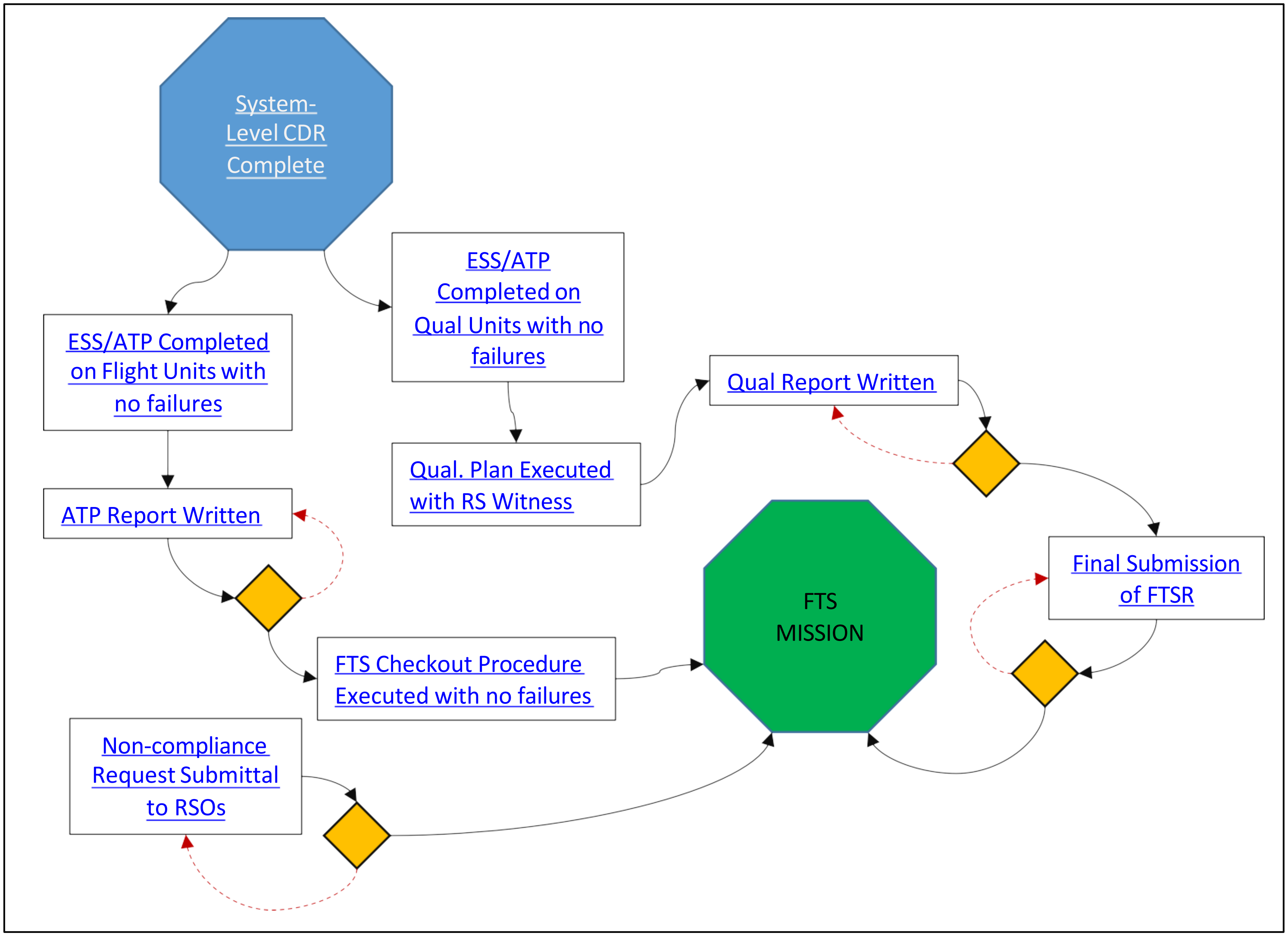


Figure D-6. From System-Level CDR to an FTS Mission

D.4 Contract Obligation

D.4.1 General RCC 319 Tailoring

This standard is a set of FTS common design and test requirements between the DoD, DOE, FAA, and NASA members. Tailoring of this standard to the unique FTS application is needed. All test ranges identified in the project test plan participate in tailoring.

There are two types of RCC 319 tailoring: general and detailed. Detailed RCC 319 tailoring is done after the contractor proposes an FTS concept and successfully completes the system-level PDR. General RCC 319 tailoring is done prior to contract award to prevent the contractor from proposing an FTS solution that is too costly to develop or sustain, as shown in the following examples.

- Stringent requirements exist for explosive FTS components. The service life[81] of explosives are limited to 1, 3, 5, or 10 years[82] depending on the device and rigor of qualification/lot acceptance testing.[83] Periodic destructive testing of lot samples is required to extend the service life of a single lot (see Subsection 4.14.3 b (1) and the footnotes to LAT tables for specific explosive components). An SLE of one explosive lot does not apply to other lots of the same part number device. Therefore, programs with explosive systems must plan to either manufacture explosive components throughout the life of the test program (with destructive testing of lot samples for each lot) or perform costly lot-extension tests to extend the life of manufactured explosive components, assuming initial lots are large enough to support extension testing. During contractor developmental testing, quantities of FTS hardware are typically low, and the number of units delivered from an explosive lot may be fewer than the number of units expended to accept the lot. During operational testing, large/multi-year quantities of FTS parts are needed. Failure of a single lot sample during lot acceptance testing is grounds to reject the entire lot, which increases the risk that an FTS will not be certified during the operational test phase.
- Software and firmware requirements are contained in Appendix A, which defines safety requirements for all system stakeholders. This includes activities related to requirements definition and refinement, software development processes and products, testing at all levels, documentation, configuration management, and system operation. An IV&V will be performed by an independent assessor (see Appendix A for definition). The program may therefore choose to restrict the use of software and firmware in a new FTS. A legacy FTS's use of a component with software or firmware does not guarantee use of the part for the new program without new IV&V testing.
- The range user may choose to require one particular method of flight termination to reduce development and sustainment costs, such as an aerodynamic termination system with no software or firmware. An aerodynamic FTS may have a larger footprint than an

[81] The RCC319 definition of service life includes storage and use. A lot's service life starts at completion of the lot acceptance test. FTS service life can expire even if the device spends its entire life in storage.

[82] An initial service life of ten years requires certain design elements to have history of functioning over 15 years.

[83] See Subsection 4.14.3 for service lives of different explosive devices. Safe-and-arm rotor leads and booster charges are discussed in Table 4-52, note 3. Explosive transfer systems, ordnance manifolds, and destruct charges are discussed in Table 4-80, note 5. All depend on the type of explosive reaction per 4.14.3.

explosive system and could therefore be less manageable on certain ranges. The trade-off decision should be made by the range user with approval of the RSO.

- The design should allow for easy access and field removal of explosives (if used) and FTS components with short certification lives. For explosives, the end-to-end checkout requires sending a terminate command through the system and measuring the current intended for the initiation device through a current viewing resistor. This requires access to explosive initiators in the field for removal. For components with short certification periods, the FTS receivers must be certified no earlier than 180 calendar days before flight. Removing the receiver in the field a few weeks prior to checkout for recertification or testing the receiver in place on the vehicle are common practices. Programs that do not allow for field-removal or in-place testing of these components must go back to the range user or their prime contractor's facility and can cost $30,000 each time components are replaced.

Return to Chart

D.4.2 Initial TIM with Range User (Prior to Contractual Obligation)

After the program defines its test plan and prior to contractual obligation, a meeting should occur between the range user and the RSOs of all potential test ranges. The purpose of the meeting is for the range user to explain the program's test plan, for Range Safety to explain the FTS development process and requirements, and to choose an LRSO. The meeting is critical because it ensures the range user allocates sufficient schedule and budget early in the program for a successful FTS development. Funding for the respective RSO staffed hours and travel must also be arranged. If the meeting results in the need to change the program test plan, updates to the test plan must be finalized prior to general RCC 319 tailoring.

Return to Chart

D.4.3 Project Test Concept of Operations (CONOPS)/Plan

See Section 2.2, Step 1. The range user should first write the Project Test Plan (Test and Evaluation Master Plan) explaining the type of testing planned at each range. The program test plan enables the RSO at each range to determine if an FTS is required to meet the test objectives on its range. It also defines the environmental conditions the FTS must survive. This is critical because FTS components are not necessarily required to meet tactical system requirements. The FTS is only required to be qualified to survive the test environments, which are generally more benign in temperature and captive carriage than tactical systems (2,000 hours vs 50 hours). The Project Test CONOPS/Plan includes (but is not limited to) the following.

- Release altitudes.
- Release speeds.
- Maximum range/flight time to be demonstrated.
- Test ranges used.
- Test vehicle configurations.
- Platforms and stations supported.

- Maximum captive carriage flight time on each platform and station.
- Maximum number of mission re-attempts (for example, if a mission gets cancelled, how many times it will be re-attempted with the same FTS).
- Maximum number of times a single FTS is expected to undergo an FTS checkout. This is required for repetitive function testing per Subsection 3.9.8.
- FTS components expected to be re-used to support multiple missions.

Return to Chart

D.5 System-level PDR with Range User or their Prime Contractor

D.5.1 Analysis Plan

The range user or their prime contractor develops the analysis plan describing how all the analysis required by Chapter 7 will be accomplished. Some analysis is done by the range user or their prime contractor at the system level. Other analysis is done by component manufacturers at the component level. For requirement traceability, analysis reports should be referenced in component/system qualification reports.

Analysis is used to verify the design before expending significant resources. Therefore, all analysis (except test failure analysis) must be completed and delivered for review prior to the CDR for the component or system, depending on the type of analysis.

Notes on some analysis are provided below. (This is not a comprehensive list of the analysis. See Chapter 7.)

- System Reliability - The predicted system reliability must be at least 0.999 at 95% confidence. This requires each component to have its own reliability allocated and predicted.
- Single Points of Failure – There cannot be any single points of failure for failure to terminate when commanded (Subsection 3.2.3.a) and for inadvertent termination (Subsection 3.2.3.b).
    - Failure to terminate when commanded is best mitigated by having completely redundant paths such that failure of a component in one path cannot cause a failure in the other. When the system architecture completely isolates the redundant paths, component manufacturers are not required to perform an analysis for failure to operate when commanded.
    - For a fully redundant system, inadvertent termination can only be mitigated at the component level. Therefore, each component manufacturer must complete a single-point-failure analysis showing a single failure in its component cannot cause system-level termination.

Return to Chart

D.5.2 FTS Certification Plan

RCC 319 requires pre-flight checkout of the complete FTS (with Range Safety witness) at the launch site to detect any change in performance due to shipping, storage, or other environments that may have affected performance after the component passed acceptance testing (Subsection 5.2.1). Tests shall be performed as close to launch day as possible (Subsection 5.2.2 #5) and are typically done within seven days of the mission. Accomplishing a complete end-to-end system checkout in the field requires early design consideration and planning in order to have access to certain test points. See Chapter 5 for a complete list of preflight test and launch requirements.

The range user or their prime contractor develops the FTS Certification Plan. It is the proposed means of accomplishing a complete FTS field certification prior to a mission. The plan should include how parts are physically accessible and testable, the access ports and plugs used, the assembly level required, and all parts/equipment required to complete the checkout safely.

The range user or their prime contractor is required to provide all calibrated support equipment for the FTS field certification (Subsections 6.1.3 and 6.5.2).

Range Safety must approve all FTS certification equipment (Subsection 6.1.1 a).

D.5.2.1 High-voltage Firing Units (Consideration for FTS Certification Plan)

Charging capacitors in high-voltage systems must be fired during the end-to-end checkout procedures. This requires explosives to be removable at the system level to be replaced with representative inert loads. After verifying the system can fire into a high-current load, the high-voltage capacitors must be checked to verify they were not damaged by the high-current discharge. This can be accomplished by replacing the flight-representative load with a high-resistance load, fully recharging the firing capacitors, issuing a terminate command, measuring the capacitor voltage bleed-down time with a high-resistance load, and comparing the bleed-down time to the expected value. A means of removing power from the capacitor bank must be available to prevent capacitors from be recharged during the test.

D.5.2.2 RF Path Loss (Consideration for FTS Certification Plan)

The RF path through the antennas must be verified to be within specification. This typically requires an antenna hat that is mounted over the antennas in a manner such that the loss due to the hat may be repeatable and calibrated.

D.5.2.3 Fail-safe (Consideration for FTS Certification Plan)

Systems with fail-safe must have a means of independently enabling each receiver's fail-safe, applying fail-safe conditions (both low voltage and loss of fail-safe tone) to each side independently, and measuring fail-safe voltage thresholds and timers.

The ability to reset the system's fail-safe timer from temporary loss of tone is typically accomplished by enabling fail-safe, dropping the fail-safe tone for half the fail-safe time period, re-applying the fail-safe tone for twice the fail-safe timer period, and verifying ARM/TERM remain below the maximum off voltage for the duration of the test.

For systems with fail-safe cross-strapping, the ability to independently inject a fail-safe cross-strap signal into each receiver (to inhibit fail-safe output) must be available to verify a system-level fail-safe terminate command is not issued unless both receivers detect a fail-safe condition.

Return to Chart

D.5.2.4 Initial Footprint

Determining if a proposed FTS solution is sufficient requires preliminary footprint analysis giving sufficient confidence an FTS concept (with any associated inhibits) is sufficient to keep a test item within the boundaries of the test range. The range user or their prime contractor develops this initial footprint analysis for review/approval by the range(s).

Return to Chart

D.5.2.5 Initial FTSR Submission

The range user or their prime contractor writes the first submission of the FTSR. It is due no later than 45 days prior to the system PDR (see Subsection 8.3 a). The FTSR formatting and content is defined in Sections 8.2 and 8.5 (and all subparagraphs). At the first FTSR submittal, the contractor will not be able to complete all required FTSR sections, but the initial submission should contain placeholders for all required content that will be populated with future updates. The qualification and analysis plans can help identify the required placeholders.

Return to Chart

D.5.2.6 Initial Qualification Plan

- The range user or their prime contractor writes the initial qualification plan.
- The document lists all the qualification requirements (environments, number of samples, and test sequence[84]) for each FTS component using the applicable qualification table in RCC 319 for each component.
- The qualification plan defines the expected method for meeting qualification, such as qualification by test, analysis, similarity, or demonstration (design verification test [DVT]).
- Subsection 4.13.6 defines QBS. If QBS is to be used, an analysis with data from previous testing must be delivered to Range Safety for review prior to the component's PDR. If data are not available to prove the similar environment, the item cannot be qualified by similarity.
- The test item level will be defined (single components vs sub-assemblies). Note, RCC 319 requires components to experience acceptance random vibration in the same configuration used for qualification. This must be considered when planning to perform qualification testing at the assembly level. See Subsection 4.12.5 c.
- Mounting hardware changes the response of FTS components to dynamic environments. All qualification testing shall use flight-specified hardware (support structure, isolators, connectors, cables, cable clamping scheme, and attaching hardware such as washers, nuts, adapter plates, cable clamps, brackets, and bolts) (Subsection 4.7.1 a).
- The location of measurement devices to verify test environments (temperature, vibration, shock, acceleration, etc.) during qualification testing must be the same placement used in

[84] The requirement to follow the test sequence defined in the test tables is in Section 4.10.8. A range user may deviate from the test sequence if it is demonstrated another order will detect any component anomaly that could occur in the required test sequence.

the environmental measurement test plan. If desired, the measurement test plan may be referred to instead of duplicating the information.

Return to Chart

D.5.2.7 Initial RVM

The initial requirements verification matrix (RVM) is a collection of all RCC 319 requirements. It must distinguish between system-level and component-level requirements. For each requirement, the initial RVM should indicate how (test, demonstration, analysis), which document/procedure (development testing, acceptance testing, qualification testing, analysis, etc.), and at which level (component, system) the requirement will be verified.

The initial RVM should clearly indicate which RCC 319 requirements will require limited or lifetime waivers. Justification for each waiver is required (see Section 1.9). Justification and submission of a waiver does not guarantee Range Safety approval of the waiver.

Return to Chart

D.5.2.8 MPE Measurement Plan

The MPE for each FTS component must be defined (Section 3.3.2). This requires measuring the environment for each platform, station, and vehicle configuration. The range user or their prime contractor writes an MPE measurement plan defining how all the environments will be measured, including the placement of measuring devices. Range Safety approves the MPE plan. Refer to Section 3.3 and all subparagraphs and textboxes for considerations and a comprehensive list of environments requiring measurement. Authority for requiring an MPE measurement plan is in Subsection 3.3.2 c.

Return to Chart

D.5.2.9 Proposed FTS Solution, Including Architecture

The range user or their prime contractor proposes an FTS solution with all required components, expected function, harnessing, flight plugs (for enabling/disabling fail-safe), and test access points. New components that will require an individual PDR and CDR are identified. The list of required FTS monitoring parameters for telemetry is defined in Subsection 3.8.2.

The design should allow for easy field removal of explosives and FTS components with short certification lives. For explosives, the end-to-end checkout requires sending a terminate command through the system and measuring the current intended for the initiation device through a flight-representative high-current load (Subsections 5.3.4 a (3) and 5.3.6 b). This requires access to explosive initiators in the field for removal. For components with short certification periods, the FTS receivers must be certified no earlier than 180 calendar days before flight. Removing the receiver in the field a few weeks prior to checkout for recertification or testing the receiver in place on the vehicle are common practices.

Pre-launch FTS power source(s) verification through either telemetry or automated FTS circuits can also lead to significant design challenges with early consideration and choices necessary. For example, will the FTS analyst on the ground verify battery voltages prior to launch/release, or will FTS hardware/electronics automatically verify battery sources? Automatic verification is more reliable and is preferred.

Return to Chart

D.5.2.10 Range Safety Meeting with System(s) Program Office (SPO) & Contractor to Discuss FTS Process

A meeting with the SPO and range user or their prime contractor is needed soon after contractual obligation to ensure the contractor understands the FTS development process and requirements. A formal, face-to-face meeting is not required. A teleconference with a method of electronic screen sharing (for slides) may be used.

Return to Chart

D.6 Flow of Requirements to Sub-Contractors

D.6.1 Abbreviated Performance Test

RCC 319 has requirements (see Subsection 4.10.5) when verifying an FTS component is operating correctly during acceptance and qualification testing, including (but not limited to):

- Monitoring and recording shall have resolution and sample rate that will detect any component performance degradation;
- Electronic components shall have input current sampled at a minimum rate of 1,000 samples per second during testing in dynamic environments (Subsection 4.10.5 b.1);
- All FTS components that are part of an ordnance firing circuit, such as batteries, SADs, or command receivers, shall have their relevant parameters sampled at a minimum rate of 10,000 samples per second during testing in dynamic environments. (Subsection 4.10.5 b.2.)

If the FTS component is being manufactured by the range user or their prime contractor, the abbreviated performance test delivered at this stage is the procedure used to verify performance of the component during testing. If the component will be manufactured by a subcontractor, this document provides the RCC 319 requirements the subcontractor must meet to verify performance and may be part of the contract documents to the subcontractor. An abbreviated performance test is required for each FTS component and assembly tested.

Return to Chart

D.6.2 Detailed RCC 319 Tailoring

Detailed RCC 319 tailoring is accomplished with the contractor and all test RSOs after completing the system PDR. Detailed RCC 319 tailoring requires a line-by-line review of RCC 319 (Section 2.2, Step 2). The assessment may include component vendors. The process is often facilitated by the use of a computer and projector where all parties can review and approve changes real-time.

The contractor can significantly streamline the detailed RCC 319 tailoring process if sufficient effort was put into the initial RVM (delivered prior to PDR).

Return to Chart

D.6.3 DVT Plan/Requirements

Development tests validate hardware design concepts and assist in the evolution of designs from the conceptual to the operational phase. The objective of these tests is to identify hardware problems early in their design evolution, so any required actions can be taken before beginning formal qualification testing and production hardware fabrication. Significant component or system design changes dictated by development test results shall also be approved by the ranges. The ranges have the option of witnessing these tests. (Subsection 4.10.1, note 1.)

The DVT Plan/Requirements defines the critical requirements and the test method required to demonstrate the design meets the requirements. For components manufactured by the range user or their prime contractor, this may serve as the final DVT plan. For items manufactured by a subcontractor, this document may only be a list of required DVT tests the subcontractor must perform prior to CDR.

Return to Chart

D.6.4 Environmental Specification

- The MPE analysis feeds the environmental specification defining the non-operating and operating environments each FTS component will experience (Subsection 3.3.2 a).
- The environmental specification defines temperature extremes, rates of change, levels, and durations for each environment listed in Subsections 3.3.3 through 3.3.13 and clearly define the levels and durations used for acceptance and qualification.
- The environmental specification must refer to the Environment Measurement Plan for requirements traceability
- The environmental specification must clearly state assumptions and limits used to define the environments, such as:
    - Approved aircraft (i.e., F-22, F-35, F-15);
    - Approved stations on the approved aircraft;
    - Planned updates for additional aircraft stations as the environmental measurement plan is executed;
    - The maximum altitude approved (based on the MPE measurement test plan);
    - The maximum captive carriage time (based on the qualification duration);
    - The maximum launch re-attempts (refer to the program test plan's definition of the maximum re-attempts for a cancelled mission);
    - Restricted flight maneuvers for each aircraft and/or station (if applicable);
    - Required stores for specific aircraft and stations to limit environmental levels (must match the configuration used in the MPE measurement plan to collect the environmental levels).

Return to Chart

D.6.5 Environmental Stress Screening/Acceptance Procedure/Requirements

If the FTS component is being manufactured by the range user or their prime contractor, this document can be the actual environmental stress screening (ESS) and ATP. If the component is manufactured by a subcontractor, this document provides the RCC 319 requirements for conducting ESS and acceptance testing. If the item is a COTS component, RCC 319 acceptance test requirements still apply. If the COTS manufacturer will not accept the risk of conducting acceptance testing, the range user or their prime contractor must complete the acceptance testing after receiving the item. If the item fails acceptance testing, it cannot be used in a certified FTS. If the component is a one-shot device (such as an explosive or thermal battery), the LAT requirements will be provided, including sample size requirements and the definition of a lot based on raw materials used.

Acceptance tests must comply with the applicable acceptance test table in RCC 319.

Performance testing during ESS/ATP vibration shall continuously monitor all performance and status-of-health parameters with any electrical component at its nominal operating voltage.

- Electronic components shall have input current sampled at a minimum rate of 1,000 samples per second during testing in dynamic environments. (Subsection 4.10.5 b.1)
- All FTS components that are part of an ordnance firing circuit, such as batteries, SADs, or command receivers, shall have their relevant parameters sampled at a minimum rate of 10,000 samples per second during testing in dynamic environments. (Subsection 4.10.5 b.2.)

Return to Chart

D.6.6 Execute Environmental Measurement Test Plan

The approved MPE test plan is executed.

Return to Chart

D.6.7 Final Qual Plan

The final qualification plan includes previous Range Safety comments and the results of the environmental specification to define qualification environments, levels, durations, and sequences of testing for each component and assembly. The plan includes quantities of each component/assembly tested. Required environmental tests, the sequence of testing, and the quantities for each test will match the applicable tailored RCC 319 qualification tables unless deviations are previously approved by Range Safety. Final determination of what will be qualified by test, analysis, or similarity is made based on the results of the environmental specification.

Return to Chart

D.6.8 Final RVM

The final RVM is an update to the initial RVM (provided prior to system PDR). This version indicates system-level requirements that will be met by the range user or their prime contractor and component-level requirements that will be met by subcontractors. The expected verification method is defined (test, demonstration, analysis, etc.). The only expected exception a subcontractor may have to an expected verification method is if the subcontractor can provide test data to the Range Safety supporting QBS that cannot be provided to the range user or their prime contractor.

Return to Chart

D.6.9 MPE Analysis

The MPE analysis feeds the environmental specification. It is Range Safety's responsibility to verify environments derived in the MPE analysis are correctly represented in the environmental specification. Therefore, delivering both documents together will expedite Range Safety review.

In the MPE analysis, the results of the environmental measurement test plan are analyzed and explained. A maxi-max approach that envelopes the highest value within a frequency band throughout the pre-flight and flight trajectory shall be used (Subsection 3.3.2 c textbox). If this becomes too conservative, it may be possible to break the MPE into different phases of flight. This methodology will require unique acceptance and qualification and will be approved by Range Safety on a case-by-case basis.

The reasoning behind the MPE levels must be explained in the MPE analysis. For example, the reasoning behind breaking the MPE into different phases of flight and the meaning of each phase of flight must be clearly explained. Qualification test durations for random vibration and their relationship to operational captive carriage limits must also be clearly explained.

Return to Chart

D.6.10 Performance Specifications

This is a system performance specification and performance specifications for each component. The performance specifications and final RVM are developed and delivered together. The performance specification and RVM may be in the same document.

D.6.10.1 Component Performance Specifications

Component performance specifications provide all the requirements for meeting the component's application in the specific system as well as all RCC 319 requirements for the type of component. For components manufactured by the range user or their prime contractor, the component performance specification from this step is likely the final component specification. For components manufactured by subcontractors, the document from this step may serve as the final component specification, or the subcontractor may elect to develop its own. Requirements in the component performance specification are verified by the component manufacturer at the component level.

D.6.10.2 System Performance Specification

The system performance specification provides all the system-level requirements, including RCC 319 requirements, for verification by the range user or their prime contractor at the system level. The system performance specification may also include the system RVM.

Return to Chart

D.7 Individual PDR(s) for each New Component

D.7.1 Analysis Plan

For items manufactured by the range user or their prime contractor, a component-specific analysis plan may be required, or the analysis plan delivered prior to the system PDR may be sufficient. Items manufactured by a subcontractor should have their own analysis plans to verify the manufacturer fully understands the analysis requirements. All component analysis must be completed prior to the component CDR.

Return to Chart

D.7.2 Component Concept

At the component PDR, the design and operational concepts proposed for the component are presented, reviewed, and approved prior to beginning engineering fabrication.

Return to Chart

D.7.3 Component RVM

Each component manufacturer must provide an RVM to show how all the component requirements flowed from the range user or their prime contractor (including RCC 319 requirements) will be met. Suggested tailoring and waivers to RCC 319 requirements must be identified for review/approval by the ranges. The RVM includes which document will be used for verification, such at the DVT procedure, acceptance procedure, qualification procedure, or analysis. The component RVM provides a handy checklist for ensuring DVT, acceptance, qualification, and performance test procedures meet all contract requirements.

Return to Chart

D.7.4 QBS Analysis Complete

Requirements for QBS are defined in Subsection 4.13.6. If QBS is used for an environment, a QBS analysis detailing how the environment is qualified by similarity based on historical test data must be delivered for review prior to the component's PDR. The QBS analysis must include the test data from legacy testing. If historical data are not available for Range Safety review, the environment cannot be qualified by similarity. Analysis used to translate and/or compare the levels and durations must be clearly explained.

Return to Chart

D.7.5 Qualification Plan

If the component is being developed by the range user or their prime contractor, the system-level qualification plan is sufficient to meet this item.

If the component is being developed by a subcontractor, a subcontractor-developed qualification plan detailing what environments will be tested, qualified by analysis, and/or qualified by similarity must be provided prior to the PDR for the new component. Subcontractors may have access to historical data unavailable to the range user or their prime contractor, allowing some qualification tests to be completed by analysis or similarity rather than through test. Historical test plans, reports, and test data must be deliverable to the government to leverage previous qualification testing.

Return to Chart

D.8 Individual CDR(s) for each New Component

D.8.1 All Analysis Complete

Analysis is preferred over testing when it is faster, cheaper, and fully capable of verifying the requirements. Analysis loses these advantages when completed after CDR. If an analysis finds a problem with the design of a system or component, any qualification testing completed on the defective design must be repeated, incurring significant schedule delays and cost overruns. Therefore, before CDR can approve the design for fabrication, all analysis must indicate the design meets all requirements. Analysis includes everything defined in the component analysis plan delivered prior to the component PDR.

Analysis reports for individual components are delivered as attachments to the component qualification report. See the contract with the range user or their prime contractor for details.

Return to Chart

D.8.2 Abbreviated Performance Test

The abbreviated performance test, ATP, and QTP are interconnected and should be delivered together to expedite Range Safety's review.

The abbreviated performance test is run during acceptance and qualification environments to ensure the component is operating correctly without inadvertent, abnormal, or missing output. Abbreviated performance tests have voltage and sample rate requirements specified in the contract from the range user or their prime contractor.

Return to Chart

D.8.3 Component Performance Specification

Each component manufacturer delivers a component performance specification. An initial performance specification is needed prior to the PDR. A final version is needed prior to submitting component schematics, analysis, abbreviated performance test, ESS/ATP/LAT procedures, and qualification procedures to the ranges for review because those documents must verify proper performance of the component, which cannot be done until the performance requirements are finalized.

Return to Chart

D.8.4 Component Schematics

Component schematics, system schematics, and analysis are developed together and should be delivered together to expedite Range Safety's review.

Component schematics are completed by the component manufacturer per Section 8.5 and subparagraphs. The range user shall provide detailed drawings, schematics, and wiring diagrams of the FTS as a system. These shall fully describe all plug and jack designations, all pin assignments, and all FTS-to-TM or other vehicle component interfaces. Additionally, all components shall be identified by component number and value such that a circuit analysis can be performed (Section 8.5 textbox). Component values such as resistance, capacitance, and wattage; tolerance, shields, grounds, connectors, and pin numbers; and TM pick-off points shall be included (Subsection 8.5.1 c (1)).

Return to Chart

D.8.5 DVT Procedure

The component manufacturer must develop a DVT procedure to be approved by Range Safety to verify the proposed design meets critical requirements prior to significant investment of resources. Prior to developing the DVT procedure, all schematic analysis should be approved.[85]

Return to Chart

D.8.6 DVT Report

A report of DVT test results is written and approved by Range Safety. The DVT test report becomes an appendix of the overall FTSR delivered by the range user or their prime contractor.

Return to Chart

D.8.7 ESS/ATP/LAT Procedure

The abbreviated performance test, ATP, and QTP are interconnected and should be delivered together to expedite Range Safety's review.

The ESS test is workmanship screening to ensure quality manufacturing. Random vibration testing during either ESS or acceptance must be done IAW Subsection 4.12.5 for levels and duration. The acceptance test configuration for random vibration must match what was done for qualification (see Subsection 4.12.5 c).

Return to Chart

D.8.8 Execute DVT Test Plan

The Range Safety-approved DVT test plan is executed.

Return to Chart

D.8.9 Qualification Procedure

The abbreviated performance test, ATP, and QTP are interconnected and should be delivered together to expedite Range Safety review. These procedures must contain instructions for stopping testing upon a failure and freezing the test configuration until RSOs can be contacted to take part in the failure investigation (see Section 4.5).

[85] If DVT testing is completed prior to analysis, and then analysis shows the circuit design must be altered, then affected DVT testing must be repeated with the updated design. This causes schedule delays and cost overruns and should be avoided.

The procedure must include notifying RSOs for witness at least two weeks prior to testing. The procedure must also require proof of the applied test environment (i.e., pictures, temperature plot, random vibration profile from accelerometers, shock plots, acceleration, humidity, etc.)

Return to Chart

D.8.10 System Schematics

Assessing the suitability of a component schematic requires having the applicable sections of the system schematic to understand how the component interfaces with the system.

A complete line schematic of the entire FTS from antenna to the termination device is due prior to the system-level CDR. The system-level schematic must include TM pick-off points and ground (umbilical) interfaces. Schematics shall be legible and use font size of at least 8 point. The entire FTS shall be depicted in not more than three sheets: size C, D, or E. All schematics, functional diagrams, and operational manuals shall have well-defined, standard, IEEE, or MIL-SPC terminology and symbols (Subsection 8.5.1 c (1) textbox). Component values such as resistance, capacitance, and wattage; tolerance, shields, grounds, connectors, and pin numbers; and TM pick-off points shall be included (Subsection 8.5.1 c (1)).

Return to Chart

D.9 System-level CDR with Range User or their Prime Contractor

D.9.1 All System-level Analysis Complete

All analysis defined in the system analysis plan is completed at this time. Analysis reports completed at the system level are formally delivered as attachments to the system qualification report. See Section 4.9 for details on test and analysis reports.

Return to Chart

D.9.2 Final Submission of FTS Checkout Procedure

The final submission of the FTS checkout procedure is delivered after the system-level schematics and analysis are completed. The system schematic is required prior to the checkout procedure to verify pass/fail criteria (voltage, resistance, current) are appropriate.

Return to Chart

D.9.3 Overall RCC 319 Compliance Matrix

An overall RCC 319 compliance matrix showing how each RCC 319 requirement is verified is required prior to CDR entry and must be approved prior to CDR exit.

Return to Chart

D.9.4 Second Submission of FTSR

Per Section 8.3 b, the second submission of the FTSR is submitted at least 45 days prior to the system CDR. The second submission of the FTSR will include updates to all appendixes completed to date for the system and each component (i.e., all completed analysis, qualification plans, qualification procedures, DVT plans, procedures, reports, ESS/ATP/LAT procedures, etc.).

Return to Chart

D.9.5 System-level Schematics Completed

To prevent duplication of review, the system schematic and system analysis should be delivered together.[86] An overall FTS schematic must be provided per Section 8.5. A complete line schematic of the entire FTS from antenna to the termination device is due prior to the system-level CDR. The system-level schematic must include TM pick-off points and ground (umbilical) interfaces. Schematics shall be legible and use font size of at least 8 point. The entire FTS shall be depicted in not more than three sheets: size C, D, or E. All schematics, functional diagrams, and operational manuals shall have well-defined, standard, IEEE, or MIL_SPC terminology and symbols (Subsection 8.5.1 c (1) textbox). Component values such as resistance, capacitance, and wattage; tolerance, shields, grounds, connectors, and pin numbers; and TM pick-off points shall be included (Subsection 8.5.1 c (1)).

Return to Chart

D.10 FTS Certification/Mission Support

D.10.1 Acceptance Test Report Written

The acceptance test report with all attached test records (pictures of test setup, environmental traces, performance test reports, test sheets, failure investigations, etc.) must be written IAW Section 4.9 to demonstrate compliance to the flight unit's performance and environmental requirements as defined in the ATP. The acceptance test report must be provided to the RSO upon request.

Return to Chart

D.10.2 ESS/ATP Completed on Flight Units with no Failures

The approved ESS/ATP must be completed on delivered flight units.

Return to Chart

D.10.3 ESS/ATP Completed on Qualification Units with no Failures

All ESS/ATPs must be completed on all qualification units prior to beginning qualification testing. Completing ESS and ATP prior to qualification also verifies adequacy of the ESS/ATP procedures. All failures during ESS and ATP must be investigated to find root causes. Corrective action to prevent recurrence must be implement before testing can resume.

Return to Chart

[86] If the schematics are reviewed before analysis is completed, and then analysis finds an issue that requires altering the schematic, it will cause schedule delays for the ranges to re-assess the schematic. It is in the contractor and program's best interest to verify the schematic meets analysis requirements before the range formally reviews the schematics.

D.10.4 Final Submission of FTSR

The final submission of the FTSR is due no later than four months before the first scheduled flight (Section 8.3 c textbox). The final submission provides the final remaining missing appendixes and clearly indicates which platforms and stations the FTS is qualified to support. It also includes all environmental limits, such as temperature limits, captive carriage duration, door-open exposure time (if applicable), the maximum number of FTS checkouts, the maximum free-flight time, and restricted flight maneuvers (if applicable). A reference in the FTSR to the environmental specification for detailed explanation of the limits is needed but not solely sufficient. The FTSR should also include the limits as a single reference for understanding the qualified FTS environments.

Under no circumstances will an FTS mission be approved without the final FTSR being provided to the test range for review and approval.

Return to Chart

D.10.5 FTS Checkout Procedure Executed with no Failures

The checkout procedure provided prior to CDR is executed to fully verify proper performance of the FTS. Such checkouts can be no sooner than seven days prior to launch.

Return to Chart

D.10.6 Non-compliance Request Submittal to RSOs

All non-compliances to RCC 319 tailoring requirements must be documented by the range user as a waiver or an ELS and submitted to RSOs for approval prior to the mission (Section 1.9).

Return to Chart

D.10.7 Qualification Plan Executed with Range Safety Witness

Range Safety is not required to witness all qualification testing, but notifications must be sent with proper notice (at least two weeks) to allow Range Safety to witness all portions of qualification testing.

Any failure during qualification of an FTS component or assembly will halt qualification of the component or assembly until Range Safety is notified, the failure is investigated, the root cause is identified, corrective actions are mitigated, and a decision is made on the appropriate place to resume qualification testing (regression testing may be required).

Return to Chart

D.10.8 Qualification Report Written

The qualification report with all attached test records (pictures of test setup, environmental traces, performance test reports, test sheets, failure investigations, etc.) must be written IAW Section 4.9 and approved by Range Safety prior to the final submittal of the FTSR. For requirements traceability, the qualification report must refer to all reports used to satisfy qualification requirements through analysis. Under no circumstances will an FTS mission be approved without the final qualification report and FTSR being provided to the test range for review and approval.