



Acquisition

**QUALITY ASSURANCE OF TRAINING
SYSTEMS CONTRACTS**

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This publication implements AFPD 63-5, *Quality Assurance*, and gives general information and specific guidance concerning Government contract quality assurance (QA) and certain other contract administration functions applicable to training systems contracts. **Attachment 1** lists the abbreviations and acronyms used in this publication.

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Chapter 1

INTRODUCTION

1.1. Terms and Definitions:

1.1.1. Quality Assurance Representative (QAR). The senior individual responsible for the Government contract quality assurance function at the training system site. On some contracts, the QAR also may be the project officer.

1.1.2. Quality Assurance Specialist. The classification title assigned to Government civilian personnel in the 1910 occupational series.

1.1.3. Project Officer (PO). The senior individual responsible for contract administration and other duties not assigned to the quality assurance representative (QAR). On some contracts, the PO may also be the QAR.

1.1.4. Quality System. The organizational structure, responsibilities, procedures, processes, and resources for meeting contract requirements and delivering conforming items.

1.1.5. Verification. The act of reviewing, measuring, inspecting, testing, checking, auditing, or otherwise establishing and documenting whether items, processes, services, or documents conform to specified requirements.

1.2. General Information:

1.2.1. This publication outlines PO and QAR responsibilities for monitoring contractor performance on training system contracts. The PO and QAR may be the same individual or (in the case of a single contract involving several sites) there may be a central PO or QAR being the focal point for data collection and overall program management issues. Training systems are defined in AFPAM 36-2211, *Management of Air Force Training Systems* (formerly AFP 50-11) or by the Program Management Directive, if applicable.

1.3. Types of Contracts. Following are four basic types of training system contracts:

1.3.1. On-Call. Contractors are required to respond to administrative contracting officer (ACO) released requests for maintenance assistance beyond the capability of user and operator activities.

1.3.2. Contractor Support. Contractor personnel are responsible for full-time maintenance support at operational work sites. This type of contract normally provides for the onsite contractor to receive spares support from the base supply activity. The contractor may also be responsible for all or part of the training system operation.

1.3.3. Contractor Logistics Support (CLS). Contractor onsite personnel operate or support operators, provide all maintenance for the training system, the Systems Support Center, or Training Systems Support Center (TSSC), and provide logistics support for the training system (other than aircraft common spares). The contractor is responsible for maintaining configuration of the Government-furnished Recompensation Support Package (RSP) in serviceable condition during the life of the contract.

1.3.4. Aircrew Training System. Contractor personnel are responsible for performing onsite CLS, as well as preparation of courseware, media selection, and instruction.

1.4. Authority in Contract Management:

1.4.1. Contracting Officers. Only warranted contracting officers can award contracts and modify or amend them. Only warranted ACOs are authorized to administer contracts assigned to them by the procuring contracting officer (PCO). Both the PCO and ACO may retain or delegate specific contract administration tasks. When the ACO delegates duties to another contract administration activity, the term "Primary ACO (PACO)" identifies the delegating activity and "Support ACO (SACO)" identifies the supporting activity. Either the ACO, PACO, or SACO may delegate specific contract administration tasks to POs and QARs assigned at operational bases. The ACO, PACO, or SACO (hereinafter referred to as ACO) releases formal letters of delegation to each assigned PO and QAR defining their specific authority, duties, and responsibilities. POs and QARs represent the ACO according to the terms of the letter of delegation. Other duties should not conflict with these responsibilities.

1.4.2. Contractual Commitments and Changes. These are made only by the PCO unless delegated to the ACO. The PO and QAR should be careful not to exceed the authority delegated to them by the ACO.

1.4.3. POs and QARs. POs and QARs are responsible for monitoring, detecting, and recognizing contract performance problems; determining required contractual changes; and addressing them to the cognizant ACO for action. No changes should be implemented without written authorization of the PCO or ACO. Failure to comply with these instructions could result in a contract ratification action. If POs or QARs become aware of any conditions not specifically recognized or required by the contract, they should immediately discuss it with the cognizant ACO and followup with a written summary. The ACO should then provide guidance to the POs and QARs on how to proceed.

1.5. PO and QAR Qualifications. Personnel selected for PO or QAR duties should have broad technical and management skills to effectively monitor contractor compliance with contract requirements. POs and QARs should understand contract administration and remain current in the latest techniques for verifying contractor compliance. They should be technically qualified in the product or service to be monitored.

1.5.1. Background. Standard civilian position descriptions have been developed for PO and QAR positions. These positions are in the 1910 occupational series.

1.5.2. Education, Experience, and Training Requirements. Education, experience, and training requirements for QA personnel (both military and civilian) are identified in the Air Force Acquisition Professional Development Program.

1.5.2.1. Organizations may assign specific QA functions to individuals not in the 1910 occupational series to assist in effectively monitoring the contractor's performance. These individuals may be referred to as training system evaluators. The following examples are provided:

1.5.2.1.1. A 1710 series training specialist determines technical accuracy of training materials and proper training techniques.

1.5.2.1.2. A 1712 series education specialist evaluates the contractor's student critique or training evaluation feedback system.

1.5.2.1.3. A 1670 series electronic equipment specialist evaluates the technical, software, and hardware characteristics and assists with the simulator certification of training devices.

1.5.2.1.4. Military subject-matter experts perform unique or specialty evaluations.

1.5.2.2. In addition, some organizations assign military members to contractor courseware development facilities as subject-matter experts to provide the contractor with the most current expertise in operational concepts and constraints. These individuals assist the contractor in resolution of technical issues and provide the expected performance requirements at entry and exit levels of training. This is not considered a QA or contract administration activity.

1.6. Standards of Conduct. POs and QARs should maintain an "arms length" relationship with contractor personnel. All POs and QARs should be thoroughly familiar with Air Force policy on standards of conduct.

1.7. Government Delay of Work. If the Government fails to provide the support specified in the contract, and as a result the contract is delayed, the contractor may make a claim against the Government. Normally, the claim is in the form of nonchargeable downtime for purposes of computing monthly availability. Therefore, adequate documentation should be maintained by the POs and QARs to make sure an audit trail of Government actions exists.

Chapter 2

CONCEPT

2.1. Overview:

2.1.1. The approach outlined in this publication for assessing contractor quality performance is innovative and is based on concepts developed as part of Total Quality concepts. It focuses on working with the contractor in a spirit of teamwork to measure and continuously improve procedures and processes resulting in quality products and services. This approach is not to be construed as authority to change the terms of any contract, alter contractor responsibility for quality, or modify the Government's basic role of monitoring contractor compliance with contractual quality requirements. Its goals are to achieve customer satisfaction, improve the quality of products and services, and reduce costs to the Government.

2.1.2. The approach is designed to examine the adequacy of the contractor's processes and performance. It incorporates the need for comprehensive knowledge of the system and the activities associated with its scope, execution, and deliverable service. It assesses the adequacy of the contractor's processes through the use of auditing principles and statistical techniques. It also promotes reduction in procedural oversight, allows flexibility, and fosters continuous improvement.

2.1.3. It is crucial that POs and QARs understand the definition and concept of "process evaluation." A "process" is the blending and transformation of inputs into outcomes. For example:

2.1.3.1. Inputs. Knowledge, equipment, tools, environment, materials, methods, people, and management.

2.1.3.2. Requirements. Drawings, specifications, technical orders (TO), expertise, etc.

2.1.3.3. Outcome. Product or service resulting from a process; e.g., software, documents, maintenance, instruction, etc.

2.1.4. QA personnel should be permitted wide latitude and flexibility in applying the methodology in **CHAPTER 4**. Supervisors and higher management should not direct or control QA activities but rather should serve as leaders or coaches. They should create an environment that provides for job ownership and pride of workmanship, and promotes innovative approaches to the QA philosophy.

2.2. Contract Review. The contract and the associated technical data describe what is to be accomplished by the contractor. Knowing what technical requirements are imposed is essential in determining how to assess the contractor's processes. It is important to review contracts and read technical data to stay informed. The QAR should examine the contract in total. Contracts contain both legal and technical requirements. The following portions of the contract contain most of the quality and technical requirements and should be thoroughly reviewed:

2.2.1. Part I contains the schedule (**Section A** through H). Section C contains the statement of work (SOW). Section E specifies the contract quality requirements. Section H contains special contract requirements.

2.2.2. Part II, section I, contains the applicable Federal Acquisition Regulation (FAR) clauses.

2.2.3. Part III, section J, contains the list of attachments that includes the Contract Data Requirements List (CDRL) and references to other technical documents.

2.3. Proofing the Adequacy of Processes. Contractors usually have established processes in place. The QAR should identify these processes and determine consistent conformance to contract technical requirements. Proofing the adequacy of processes allows the QAR to assess how accurately and effectively contract requirements are met; thereby providing confidence in those established practices that are in place and providing early identification of problems.

2.4. Process Analysis, Examination, and Audit. Process analysis is an examination or test continually performed to assess the contractor's ability to measure and control processes effectively. Process analysis confirms that the process is in control and that it is providing products or services that conform to contract requirements. Audits assess the effectiveness of contractor performance in various categories or areas of activity.

2.5. Data Collection and Analysis. The contractor's compliance to contract requirements is demonstrated to the Government by providing suitable objective evidence that controls are adequate. This includes the rationale used in developing these controls and, in turn, the facts and data used by the contractor to determine that they are adequate. The QAR should collect and analyze sufficient data to confirm that established controls will produce the intended results. Likewise, to be objective, evidence provided by the contractor should indicate the measured results of examinations and tests and should be verifiable. Checkmarks are not satisfactory objective evidence where the inspection characteristic involved requires a specific measurement to establish conformance. When analyzing data for trends, the stability of the process, in addition to positive results from both the process proofing and process analysis, may justify the reduction of inspection activity in favor of continued data analysis and audits.

2.6. Communications and Relationships:

2.6.1. A fundamental objective is customer satisfaction. This satisfaction is increased through effective communications with the buying office, technical support activities, user, and contractor management at all levels. Maximum use should be made of verbal (face-to-face) communications to effect appropriate corrective actions while enhancing continuous performance improvement. Contractor personnel should meet with Government personnel as needed to resolve problems at the lowest possible level.

2.6.2. POs and QARs should establish and maintain good working relationships with the contractor to identify obstacles to good performance at the earliest possible time; to identify whether they can be resolved within the terms and conditions of the contract and delegation; and to mutually agree on the course of action required; and then to pursue the required course of correction through their respective channels (contractors through their home office, POs and QARs through their unit, base, and command on operational and support matters and through their ACO on contractual matters).

2.6.3. Government contract QA personnel should periodically talk (or meet) with the contract administration office, ACO, or the program manager to discuss difficulties relating to the contractor's quality performance. The data, charts, and graphs generated from Government evaluation and analysis should be used during these discussions. The QAR should never hesitate to discuss matters of quality with the PO and the ACO at anytime. POs and QARs need direct communication with the unit, base, and command representatives and the ACO. If verbal discussions are not effective, written requests for assistance to the ACO should be used. Major commands should be sent copies of significant contractual correspondence.

2.7. Corrective Action. Corrective actions should be targeted to performance deficiencies. Generally, these deficiencies are identified through Government examinations, process proofing, or customer complaints. Although emphasis is placed on verbal communications and solving problems at the lowest levels, if requests for corrective actions have gone unresolved, written notification and escalation of actions to the ACO should be accomplished.

2.8. Continuous Improvement Opportunities (CIO). A major goal is to improve quality performance through improved processes. Contractor data relative to internal processes should be obtained for analysis. This data is the recorded results of contractor inspections and tests. Total visibility is necessary for identifying areas where quality or performance improvements might be attained. Government analysis may identify areas where the potential for contractor improvement exists.

2.9. Department of Defense (DoD) Verification Stamps. Use of stamps by QARs is discouraged. The QAR's signature should be sufficient to indicate status.

Chapter 3

PROJECT OFFICER RESPONSIBILITIES

3.1. Responsibilities in Base Support. A copy of the contract should be provided to the PO by the contracting activity before contract performance begins. The PO should review all the administrative, operational, logistic, and security support requirements so that any questionable support requirements can be addressed and resolved before or at the Post Award Orientation Conference. The PO should consult and coordinate with all affected unit, base, and command activities to ensure adequate support and access when the contractor arrives. The support to be provided should be set out in the contract. Support could include (but is not limited to) the items listed below. Each contract is unique; therefore, the PO should know when, where, and how to interface with unit, base, and command activities.

- 3.1.1. Facilities (work space, access to Government shops, office space, etc.).
- 3.1.2. Logistics support (supply support, technical data, emergency medical attention, transportation, etc.).
- 3.1.3. Administrative support (pass and identification cards, vehicle registration, postal services, banking privileges, etc.).
- 3.1.4. Operational support (work and training schedules, base exercises, etc.).
- 3.1.5. Security support (clearances, access passes, disclosure, etc.).

3.2. Responsibilities in Management Support. The PO acts as liaison between the unit, base, and command officials, and the contractor; represents the ACO in contractual matters as authorized in the delegation letter; and verifies that the contractor is performing required tasks satisfactorily.

3.3. Evaluation of Contractor Performance. The ACO may require the PO to prepare and submit an evaluation report of the contractor's performance. A quality information report prepared by the QAR should be attached to the PO evaluation. These two reports document how effectively the contractor is performing and provide a means for confirming problems discussed by the POs, QARs, and the ACO during the report period. Copies of these reports are provided by the PO to the unit, base, and command commanders (or their designated representatives) and to the contracting activity. These reports should not be provided to the contractor, except as authorized by the ACO.

3.4. Reporting Accidents and Safety Violations. The contract usually includes contractual safety standards and accident reporting procedures. In addition to unit, base, or command reporting requirements, the POs (or their designated representatives during periods of absence) should report all accidents to the ACO by the most expedient means available (telephone conversation, facsimile, or message). Accidents involving personal injury or damage to Government property should be reported no later than the end of the next workday. The PO should immediately notify the contractor of observed safety violations that pose an imminent threat to personnel or Government property so that the violation can be corrected as soon as possible. The PO should report to the ACO on these matters by telephone conversation or facsimile (if the contractor does not initiate immediate corrective action). All safety violations should be summarized in the QAR's monthly report. References to all such submitted reports should be summarized in the "remarks" block of the PO's monthly reports.

3.5. Property Control:

3.5.1. The PO should be familiar with the contract, including the applicable Government property clause. This clause authorizes surveillance over the contractor's property control system for Government-furnished property. For an explanation of the clauses, see FAR, Part 45, *Government Property*, current edition. The property clauses state whether or not a property control system is required according to FAR, Subpart 45.5, *Management of Government Property in the Possession of Contractors*, current edition. The ACO, or the property administrator, if authorized, should review the contractor's system and approve the procedures for use on the contract. The PO should discuss noncompliance with approved procedures or practices that prove inadequate to guarantee control of Government-furnished property with the contractor's site manager. Should a disagreement arise, the matter should be referred to the ACO.

3.5.2. The contractor's system should provide for accountability and control of contractor-acquired property (CAP) and factory repair (when authorized by the contract), as well as cannibalization actions, maintenance of bench stocks, local purchases, and equipment acquisition and support, plus all other facets of the supply support and property control which may be applicable to the specific contract. The contractor should also provide proper identification and tagging of contractor- and Government-owned property, protection, handling, inspection, and maintenance of property and posting of periodic inventory results. Contractor liability for lost, damaged, or destroyed property is governed by the contract.

3.5.3. When CAP is specifically authorized and funded in a contract, the contractor should first exhaust all avenues of supply from Government sources. Before authorizing expenditure of CAP funds, the PO should make sure the requested materials cannot be provided by the Government in a timely manner. Documentation of supply cancellation or bad supply status is necessary before authorizing the contractor to purchase under CAP. The CAP purchase approval is authority for a one-time purchase, and the item purchased should be immediately consumed in the training systems. Similar controls are required for items of factory repair (if authorized and funded in the contract).

3.5.4. In CLS and aircrew training system contracts, large quantities of spares and support equipment may be provided, to or by, the contractor as part of an RSP. The PO should make sure the contractor has adequate controls, that an audit trail exists, and that the contractor is maintaining all spares and support equipment according to the contract.

3.6. Security. If access to classified material or information is involved, a DD Form 254, **DoD Contract Security Classification Specification**, should be part of the contract. The contracting activity should have already furnished a copy of the DD Form 254 to the cognizant security office designated in block 6 of the form. If the work is being performed on an active installation, base security police are responsible for security surveillance. In this instance, the PO should make sure the base security police have a copy of the DD Form 254 before contract performance is initiated. If work is not being performed on an active installation, responsibility for security inspection remains with the cognizant security office designated in the DD Form 254. Any questions regarding security clearances should be referred to the cognizant security office with a courtesy copy to the ACO.

3.7. Visitor Control. Visitors normally clear their visit with the PO before arrival. A Visitor's Register should be established and maintained at the training system site.

3.8. Training Schedules. The PO may be required to meet with wing and squadron training personnel to determine aircrew training devices training schedules and to provide weekly training schedules and daily updates to the contractor. Both the contractor and training systems schedulers should work with POs to alleviate problems caused by equipment downtime or changing training requirements, and to minimize training device limitations on training programs. At the same time, the PO should provide an assessment of trainer availability. The PO should work closely with outside activities to plan for installations, modifications, test and evaluation inspections, and simulator certification of assigned training systems.

3.9. Participation in Reviews and Meetings. The PO may participate in reviews of contractual documents or meetings on contractual matters, or to help resolve operational problems.

3.10. Closeout of Contracts. After all contractually required work has been completed, the FAR requires certain actions be taken to close out the contract. Even if there is a follow-on contract, the old contract should be formally closed. PO actions to assist the ACO in closing out contracts are outlined below.

3.10.1. Verify the contractor has properly inventoried and accounted for all Government-owned spares and support equipment and that spares and support equipment are either returned to Government custodians or transferred to another active or follow-on contract in serviceable condition. This accounting and transfer includes items with established "Due-In From Maintenance" dates, outstanding supply restrictions, or due-in from the contractor. Shortages should be resolved before closing out a contract.

3.10.2. Make sure all CAP has been received and the accountability for residual CAP has been transferred to the Government.

3.10.3. If contractor personnel do not perform on a follow-on contract, make sure the following items are turned in to the appropriate base offices:

3.10.3.1. Identification cards.

3.10.3.2. Security badges.

3.10.3.3. Supply authorization cards.

3.10.3.4. Privilege cards (messing, base exchange, etc.).

3.10.3.5. Base access car decals or passes.

3.10.3.6. Keys for simulator building, shops, or storage areas.

3.10.3.7. Government-owned microfilm, technical data, software, etc.

3.10.3.8. Office supplies furnished by the Government.

3.10.4. When a follow-on contract is issued to the incumbent contractor, turn-in of Government-owned property, supplies, etc., is not necessary. Only the records need to be changed or reinitiated. All involved offices should be notified of the succeeding contract number, type of work, scheduled completion date, etc.

Chapter 4

QUALITY ASSURANCE REPRESENTATIVE RESPONSIBILITIES

Section 4A—General Responsibilities

4.1. Government Contract QA:

4.1.1. The QAR is responsible for Government contract QA, including acceptance of supplies and services for the Government as specified in the contract and in the letter of delegation. The QAR is responsible for developing a program or systematic approach for assuring that the contractor has implemented an effective quality system consistent with the requirements of the contract and that the system is providing conforming products or services. This program is called Government contract QA.

4.1.2. The QAR is expected to adapt Government contract QA to the particular contract situation to ensure the most effective use of Government resources. The authority to adapt and adjust as necessary does not alter the basic responsibility for assuring that the supplies and services received are of the quality required by the contract. The QAR should not direct changes in the use of contractor resources. QARs should advise the ACO of the need for such changes.

4.1.3. Qualified personnel should administer the QA provisions of the contract. Normally, QARs are administratively assigned to the wing director of operations at each base to monitor contractor performance relative to training devices, depot repair areas, and TSSCs or software support centers. QARs receive guidance and direction from the ACO in matters relating to contract administration and QA.

4.2. Acceptability of Contractor Quality Procedures. The responsible contracting activity should complete an initial evaluation of the contractor's written quality procedures and then request the onsite QAR also to perform an evaluation. The contractor should be notified of any areas not in compliance with contract requirements. The onsite QAR may request additional quality procedures to implement site unique requirements. These procedures should be reviewed by the onsite QAR before implementation, and if unacceptable, the ACO should issue the contractor a notice stating the reasons for the unacceptability.

Section 4B—Service Contracts

4.3. Overview. This section is intended to provide broad guidelines. QA personnel should use professional judgment in tailoring these guidelines to the specific contracts they are assigned to administer in order to implement an effective and efficient Government contract QA program.

4.4. Contract Review:

4.4.1. The most critical element for successful Government contract QA is knowledge of the contract requirements and the contractor's operations. Each contract should be read in depth by the QAR to understand the requirements of the contract and technical data package. Military specifications and standards applicable to the contract should be part of the documented record. When follow-on contracts are received, the review should focus on the differences between the technical requirements of the new and old contracts and the associated impacts on contractor processes.

4.4.2. Contract review should be documented. The method of documentation is at the discretion of the QAR. The review may be evidenced by a computer data base or by simply marking up the contract and associated technical documentation.

4.4.3. A listing of contractual requirements should be created and maintained in a computer data base or it may be handwritten. The listing should be comprehensive and provide the correct issue, including any changes or amendments, specifications, standards, technical manual references, SOW, and quality requirements. It also can serve as evidence of contract review.

4.5. Knowledge of Contractor Processes. The contractor should establish processes to accomplish the contract requirements. These processes can be divided into categories by the QAR for ease of proofing and should parallel the contract requirements. A list of categories in **Attachment 2** provides a management tool to identify trends of compliance and noncompliance during contract performance.

4.6. Planning and Proofing the Adequacy of Contractor Processes:

4.6.1. The QAR should identify the processes used by the contractor to comply with contract requirements and select a method to transpose them into evaluation tools. This may include generating process flowcharts, utilizing contractor graphs and charts, or creating a simple notation and narrative checklist (**Attachment 3**).

4.6.2. QAR evaluation tools should be developed by observing the actual work being accomplished and verified against contract technical requirements. At the same time, the QAR should identify the contractor's measurement points. A single document may be sufficient or a breakdown of the process may be more appropriate. Documenting this activity should provide data needed to analyze the effectiveness of the process. Through this proofing action, the contractor's quality system can be verified as complete and adequate.

4.7. Selecting the Method of Process Analysis. The QAR should consider the following factors when reviewing the contract requirements and selecting the method of process analysis examination; e.g, flow-chart or notation and narratives.

4.7.1. How does the contractor control the process?

4.7.2. Does the contractor collect data in the process?

4.7.3. What type of data is collected?

4.7.4. Can the data be used at this point and how?

4.7.5. Can the data be collected further in the procedural flow?

4.7.6. Is the data computer generated or manual?

4.7.7. Is it a special process and has it been proofed (e.g., soldering wire wrap, electrostatic discharge requirements, graphics, etc.)?

4.7.8. Are there special or critical requirements in the process per technical contract reference (e.g., mandatory inspection, testing, or Government verification)?

4.7.9. What is the process (e.g., scheduled or unscheduled maintenance, software and courseware development, parts purchasing, depot, or local repair)?

4.8. Performing Process Analysis:

4.8.1. Process analysis is used to verify that the contractor's action will ensure compliance to contract requirements. Documentation or visual observation of the contractor's efforts should be employed to establish confidence in the contractor's performance. Documentation should contain enough information to indicate a specific process was accomplished. Until the Government representative has confidence in the contractor's documentation, observation of the contractor's activity is the more appropriate method to verify compliance with the contract requirements.

4.8.2. Process analysis normally includes the following steps:

4.8.2.1. Conducting an initial examination or test on individual activities to determine if the process meets the established acceptance criteria, produces consistent results, and ensures the entire category or area of activity has been examined. Performing examinations or tests as early in the contract life cycle as possible to prevent defects or nonconformances from developing.

4.8.2.2. Proofing the adequacy of the contractor's methods for measuring the results of processes and recording and analyzing the results.

4.8.2.3. Identifying if process results or test data are maintained in manual records and files, or are entered into computers.

4.8.3. Confidence in the contractor's methods for setting up and controlling processes is established over a period of time. The QAR should proof the adequacy of each new or changed process. A periodic examination of the process should be conducted and applied to an entire category as part of an audit schedule. Process audits should be performed after contractor inspection or test to assess the adequacy of the contractor's overall measurement techniques and controls. Process analysis should be reconsidered when circumstances warrant and when contract categories demonstrate adverse trends to contract performance.

4.9. Data Collection. The QAR should determine what contractor data is needed for process measurement points identified during development of the process analysis. This data may or may not be automated. Some contractors have automated data bases with periodic charts generated for items such as diagnostic examinations or system reliability. Even when not automated, the QAR can construct a scenario for compliance or noncompliance with contract requirements as demonstrated by process results.

4.10. Contractor Data Analysis:

4.10.1. Analysis of contractor data should be performed periodically (e.g., weekly, monthly, etc.) by the QAR to determine which areas or processes show adverse trends or lack of improvement. Pareto analysis may be performed to determine the nonconformances causing the majority of problems in each category, subcategory, or subject. Pareto analysis can isolate the nonconformances to a particular process (i.e., maintenance, documentation, shipping, training, etc.).

4.10.2. Once a nonconformance is identified, the QAR should determine if the contractor is aware of the problem, is analyzing the cause of the problem, and has implemented corrective action. If no action has been taken, the contractor should be asked to provide an explanation. The QAR should keep in mind that getting the contractor to correct a nonconformance may only require bringing it to the attention of the contractor's representative and allowing time to correct the problem. The contractor's data and records should provide insight into the following:

- 4.10.2.1. The contractor has assigned a responsible individual to answer or research problems or deficiencies.
- 4.10.2.2. Reasonable suspense dates have been assigned.
- 4.10.2.3. Problems or concerns are tracked to successful conclusion.
- 4.10.2.4. Action has been taken to force resolution of problems.
- 4.10.2.5. The contractor has reviewed the corrective action taken to the affected software or documentation.
- 4.10.2.6. The contractor is compiling statistics or data on corrective action for use in trend analysis and adjusting or updating the quality system when necessary.
- 4.10.2.7. The appropriate level of contractor management is apprised of corrective action requirements.
- 4.10.2.8. Contractor management is responsive to quality concerns and will force resolution of problems when necessary.

4.11. Government Data Analysis:

- 4.11.1. As with contractor data, the QAR should maintain records (manual or automated) or charts and graphs, as applicable, on the results of Government process analysis, examinations, CIOs, user data, and audits. As long as the contractor is meeting the contractual quality requirements, the QAR should use available data for collection and analysis.
- 4.11.2. The QAR should interpret data to determine the following:
 - 4.11.2.1. What process is involved?
 - 4.11.2.2. Where did the defect occur?
 - 4.11.2.3. Is the process acceptable, marginally good, or clearly bad?
 - 4.11.2.4. Do defects indicate the process cannot maintain contract requirements?
 - 4.11.2.5. What are the significant problem areas, trends, etc., indicated by Pareto analysis of non-conformances?

4.12. Corrective Action Requests (CAR):

- 4.12.1. CARs are issued for contractual nonconformances detected during performance of Government contract QA. Corrective action should be initiated and tracked on identified nonconformances. The exact method of corrective action is left to the contractor's discretion.
- 4.12.2. There are two general categories of CARs:
 - 4.12.2.1. Those resulting from deficiencies identified through the contractor's internal review systems.
 - 4.12.2.2. Those resulting from deficiencies identified by the Government.
- 4.12.3. CARs are either verbal or written. QA personnel should determine which method to use. The following factors should be considered:

- 4.12.3.1. Criticality of the defect.
 - 4.12.3.2. The number of times the defect was observed.
 - 4.12.3.3. The effects of the defect on reliability, maintainability, or operations.
 - 4.12.3.4. Whether the contractor has planned or taken corrective action.
 - 4.12.3.5. The contractor's reluctance to initiate corrective action.
 - 4.12.3.6. Whether ineffective corrective action has been previously attempted, etc.
- 4.12.4. The QAR's analytical ability and knowledge of the contract and the technical requirements are needed to determine the adequacy of the contractor's actions. If the contractor's actions are not adequate or fail to recognize the need for corrective action, the QAR should take one or more of the following actions:
- 4.12.4.1. Discuss the situation with the contractor.
 - 4.12.4.2. Issue a written CAR.
 - 4.12.4.3. Escalate corrective action to the ACO. If corrective action has been implemented, the QAR should determine adequacy by tracking nonconformances (by conducting a process analysis examination) until confidence is restored.
 - 4.12.5. All CARs should be discussed with the responsible elements of the contractor's organizational quality function. A written CAR should be distributed to the responsible elements and quality organization. All CARs should be entered into a manual or computer-based log. The QAR should verify that the corrective action proposed, initiated, and implemented by the contractor is adequate as evidenced by the absence or reduction of the defect in future follow-on analyses of data.

4.13. Methods of Escalation for Corrective Action:

- 4.13.1. When there is a serious nonconformance or noncompliance problem, a request for a letter to the contractor should be sent to the ACO for action. The QAR should provide the ACO documented evidence of the problem when requesting such action. The letter should be sent by the ACO to the contractor's top management requesting immediate corrective action of the cause of the problem.
- 4.13.2. The QAR should promptly verify the adequacy of the contractor's corrective action in response to the ACO letter and results of this verification should be sent to the ACO.

4.14. Continuous Improvement Opportunities:

- 4.14.1. CIOs document where opportunities for improvement exist. CIOs are not necessarily areas of high nonconformance rates; they are simply a means of streamlining and improving the process.
- 4.14.2. Improvement recommendations are provided to the contractor either verbally or in writing. The contractor determines what course of action will be taken on the recommendation. Government contract QA personnel should never direct or tell a contractor how to change a process in order to improve it. In addition, they should never mandate that a contractor improve a specific process as long as the contractor effectively detects and corrects nonconformances according to the terms of the contract.

Section 4C—Configuration Management (CM)

4.15. Overview:

4.15.1. CM is aimed at providing controls to establish, process, and maintain documentation of hardware, software, and courseware in systems and equipment. Identification of formal configuration items (CI) is established by the Government with strict control over all changes to make sure the items match the documented functional and physical characteristics. Additionally, CM is the key to ensuring a viable RSP.

4.15.2. When the Government contracts for CM, the deliverable data requirements are set forth in the CDRL. These data requirements, along with the appropriate data item descriptions (DID), identify the essential data and format requirements for CM. For each data requirement, there should be a corresponding SOW requirement outlining the contractor's responsibility to perform the work according to the appropriate Government standards, data requirements, and DIDs.

4.16. CM Plan:

4.16.1. The contractor normally develops, coordinates with the Government as required, and implements a CM Plan to make sure the CIs can be produced, operated, and supported according to contract requirements. The CM Plan details how changes are identified, approved, worked, and validated to determine the effectiveness and cost of CM.

4.16.2. QARs should make sure the CM Plan fully documents and controls the CIs. The major elements of a CM Plan are:

4.16.2.1. Identification of the CIs.

4.16.2.2. Change control procedures.

4.16.2.3. Change documents.

4.16.2.4. Review and approval process.

4.16.2.5. Configuration Control Board.

4.16.2.6. Status accounting.

4.16.2.7. Configuration audits.

4.16.3. Once the CM Plan is approved by the contracting activity, the QAR should establish a Government contract QA program to ensure compliance with the approved procedures. The QARs and other designated Government representatives should be involved with the contractor's change process to ensure resources are being properly used, priorities are consistent with the Government's needs, and overall quality and integrity of the CIs. The QAR should participate in functional configuration audits and physical configuration audits.

Section 4D—Software Development (SD) and Support

4.17. Overview. This section provides guidance to the QAR relative to Government contract QA actions to be applied to TSSCs and sites or locations generating computer software and software-support products. It also identifies typical QAR tasks during different phases of SD. Not all SD tasks are involved in contracts due to program office requirements.

4.18. Requirements Analysis Phase. During the requirements analysis phase, the QAR should perform the following tasks:

4.18.1. Document Review. The QAR should review advanced copies of contractor plans and procedures for information applicable to the contractor's Software Quality Assurance (SQA) Plan for compliance with all contractual requirements. As a minimum, the QAR should review the SQA Plan, Software Configuration Management (SCM) Plan, and SD Plan. Comments should be provided to the contractor and contracting activity expeditiously. The QAR should be familiar with the software requirement specification, software specifications, and test plans as necessary.

4.18.2. Design Review. The QAR should proof any new contractor procedures written since the Requirements Analysis Phase and perform audits accordingly. The QAR should review the contractor's work tasking procedures and updated SD Plan, and check that authorized changes are incorporated in updated software documentation and reported according to contractual requirements. Additionally, the QAR should verify that computer software configuration item (CSCI) test planning meets contractual objectives and attend design reviews and other program reviews as required.

4.18.3. Detailed Design Code and Unit Test Phases. Some documents may undergo an evolutionary cycle where a document matures through a process where areas "To Be Determined" are defined and filled in and designs are stabilized. Documents most likely to undergo this cycle are the SD Plan, test plans, test procedures, and the various functional plans, such as the SQA Plan and SCM Plan. Concurrently, SD files should reveal this evolution. Also, contractors should be creating the necessary test plans and procedures. The QAR should witness formal testing and make sure CM and library controls are effective and according to the SCM Plan.

4.18.4. Development and Maintenance Phase. When contracts require that maintenance of computer software remain with the developing contractor, the following areas may be monitored to make sure field complaints and modification requirements are properly addressed:

4.18.4.1. Testing and fault isolation.

4.18.4.2. All changes made to code are approved and all affected software documentation is updated.

4.18.4.3. Reviews and SQA audits.

4.18.4.4. Corrective action.

4.19. Control of Firmware:

4.19.1. Computer programs often take the physical form of Read Only Memory (ROM) chips in microprocessor based defense systems. These complex memory devices contain the binary instructions and data that control these defense systems and are computer software known as firmware. Firmware is a variety of ROM chips that act as a form of media. This combination of binary instructions and data resides in media that cannot be modified without the use of specialized devices. The firmware for hardware systems microcomputer circuitry is generically identified as ROM or Erasable Programmable Read Only Memory.

4.19.2. The transformation of source level programming code into the binary instructions required of firmware is a critical process requiring an active involvement by the contractor's SQA personnel. Programming a ROM chip is normally made up of the following areas:

- 4.19.2.1. The source code file is compiled or assembled into an object level file (machine-readable code).
- 4.19.2.2. The separately compiled units are linked to become an executable program.
- 4.19.2.3. The program is downloaded to a logic development station to program the ROM chips.
- 4.19.2.4. The chips are compared to the downloaded file to make sure no errors or defects were introduced in the ROM.

4.19.3. QARs should monitor the contractor's control of firmware by assuring SQA and CM procedures adequately address their use.

4.20. Evaluation Methods:

4.20.1. Three common methods are employed by contractors to improve computer software quality as follows:

- 4.20.1.1. Software quality evaluation.
- 4.20.1.2. Acceptance testing.
- 4.20.1.3. Independent verification and validation (IV&V).

4.20.2. The above methods work with each other but do not overlap. Each method has a distinct objective and established set of procedures.

- 4.20.2.1. Software quality evaluation defines sound computer SD practices and ensures compliance through internal control.
- 4.20.2.2. Acceptance testing demonstrates that the developed computer software achieves performance requirements.
- 4.20.2.3. IV&V makes sure the developed computer software will not fail during the operational mission. It is performed by a group organizationally independent of the computer SD project staff. Contract administration personnel perform Government contract QA but do not normally perform IV&V functions. IV&V is normally performed by an independent Government agency or contractor designated by the contracting officer or by a subcontractor to the prime contractor.

4.20.3. If the IV&V contractor is designated by the contracting officer, the QAR's functions and relationship to the IV&V contractor should be identified by the quality assurance letter of instruction (QALI) or the contract. If the QALI is not specific on this matter, the QAR should request clarification from the contracting officer. The QAR also should make sure the prime contractor has an adequate process to analyze discrepancies identified by the IV&V subcontractor and to take corrective action.

4.20.4. The technological advancement and increasing complexity of computer software require the QAR to solicit technical support when necessary. This support may be provided by quality engineering or the SQA staff specialist, or through specific direction or support from the buying activity.

4.20.5. There are two basic types of computer software: deliverable and nondeliverable:

- 4.20.5.1. Deliverable computer software is contractually required to be developed and delivered to the Government as part of the hardware, firmware, or as a separate line item.

4.20.5.2. Nondeliverable computer software is not required to be delivered to the Government, but needs to be controlled by the contractor if it has an impact on the quality of the product or service being purchased.

4.20.6. Deliverable computer software is such a complex product that end item inspection or test cannot be used alone to ensure quality.

4.20.7. Government contract QA of computer software begins early in the development cycle. The QAR should pay particular attention to the design phase of computer SD. The cost of correcting design errors increases in proportion to the phase in which these errors are found.

4.21. Process Proofing and Auditing:

4.21.1. The contractor's methodology for computer program design is presented in the SD Plan or the Computer Program Development Program. Contractors generally use a SD file or unit development folder for development of computer programs. The software design emerges within the files or folders. The QAR should review a sample of these files. The contractor should have procedures and controls for the content and use of the files. The QAR should attend selected internal design reviews or walk-throughs as part of the evaluation to make sure they are conducted according to procedures. The QAR should verify when required by contract that each design is subject to an internal independent review or walk-through before its release for code.

4.21.2. The QAR should proof and audit the adequacy of the contractor in the following areas:

4.21.2.1. Software configuration control board processes when this board is required by contract.

4.21.2.2. Control of the code and associated technical documentation that defines the baselined or evolving configuration of a CSCI. The majority of problems on large scale SD efforts occur during code and unit or integration testing due to the iterative nature of SD.

4.21.2.3. The contractor's procedures for control of software discrepancy reports.

4.21.2.4. The contractor's procedures for control of Government-furnished software.

4.21.3. The QAR should verify the existence of a controlled library. The QAR should verify that documentation and code are properly accepted into the controlled library and that only authorized changes are made to controlled items. The QAR should evaluate the release of documentation and code from the library to make sure it is controlled. While acceptance and release procedures are of concern to the QAR, the proper storage of software items should not be overlooked. Key areas of concern with storage include the following items (when required by the contract or the contractor's procedures): library access control and timing and types of disaster backup files and offsite storage.

4.21.4. The QAR should verify, by way of objective evidence, that the contractor has reviewed the documentation before submittal to the Government. A primary concern should be the contractor's submittal of documents with known problems; i.e., Is the contractor sacrificing quality to meet milestones? If the contractor's procedures indicate the need for approvals for the release of documentation, the QAR should verify that documents submitted have the appropriate approval signatures. As part of the evaluation, the QAR may select a sample of documents submitted in the past and review these documents, or a portion of each document, against the appropriate DIDs to ensure adequacy of the contractor's posting or updating procedures.

4.21.5. The contractor's software quality group generally does not review code until it is ready to be baselined. Baselining in this instance refers to the contractor's internal configuration control. The QAR should verify that each module of code has undergone all contractually required reviews or audits, and discrepancies are reported and corrected before library acceptance.

4.21.6. The following areas are important and should be monitored:

4.21.6.1. Support software should be proven suitable for use or approved by the Government if required. Support software configuration should be controlled.

4.21.6.2. The contractor's quality system should make sure test procedures fully implement all specification requirements.

4.21.6.3. Testing is conducted according to written procedures, where contractually required. Software configuration should be verified.

4.21.6.4. Adequate standards for retesting are established and implemented. These should address retesting of all modules affected by software changes as well as restart points for such testing.

4.21.6.5. Procedures exist for control of changes to object code (patching). These should address patch approaches, documentation, logs, and patch removal through source code update.

4.21.6.6. Test results should be accurately recorded and reported according to contract requirements and contractor's procedures.

4.21.6.7. Discrepancy reports are accurate and complete. They should be tracked and discrepancies corrected. Trends should be analyzed.

4.21.7. The contractor's SQA Plan and SCM Plan should define a variety of internal reviews, audits, and inspections to be performed by the contractor. The QAR should verify that objective evidence (reports, records, or checklists) exists and that all required reviews, audits, or inspections were completed as prescribed by the contract requirements and the contractor's detailed procedures. The contract often requires a variety of reviews and audits. The QAR should monitor these reviews and audits to make sure they are conducted as required.

4.21.8. The QAR should verify:

4.21.8.1. The existence of automated tools used to support SD.

4.21.8.2. That CM and software QA are identified and documented.

4.21.8.3. That media are placed under internal configuration control. The QAR also should verify that objective evidence exists before the use of such tools. The contractor's procedures should describe the techniques and methodology that support QA objectives in error analysis, data collection, testing support, requirements traceability, audits, reviews, inspections, etc.

4.21.9. The contractor is responsible for activities that influence quality and for maintaining control of those activities to make sure quality is not degraded. The QAR should:

4.21.9.1. Make sure tools used to support QA, SD or testing, or CM are presented in the QA Plans, CM Plans, or SD Plans, as appropriate.

4.21.9.2. Verify that tools perform required functions before being used.

4.21.9.3. Alert the PCO through the ACO of support tools not described in the deliverable plan.

4.21.9.4. Verify adequate and effective software systems engineering techniques are being used.

4.21.9.5. Verify adequate and effective software systems engineering methodologies are being used. Flow diagramming may be used. (Nondeliverable software may be necessary for the ongoing support of the operational system. The developing contractor may not be the eventual support contractor; therefore, all software tools should be properly documented.)

4.21.9.6. Verify if computer aided software engineering is being used and that it supports the requirements of the SD standard in the contract.

4.21.10. The contractor's records may be in a format as determined by the contractor and usually contain evaluation data, participants, criteria, results and, as a minimum, recommended corrective action.

4.21.11. If a portion of the SD has been subcontracted, the QAR should verify that the appropriate contractual quality requirements have been levied on the subcontractors. Initially, the QAR should review evidence of an evaluation of the subcontractor when contractually required. When appropriate, the QAR should request from the ACO, a QA delegation to the cognizant QAR of the subcontractor facility. The QAR should note the software and documentation submittals required from the subcontractor and verify at the appropriate time that the submittals are received, reviewed, and accepted by the prime contractor. If not, the QAR should notify the ACO of possible schedule slippage. The QAR should review the contractor's reviews, audits, tests, or inspections at the subcontractor's facility.

4.21.12. The QAR may create process concept evaluations that combine software tasks into a related sequence of events. The QAR can evaluate the contractor's quality system as more of an integrated entity versus a fragmented evaluation over specific points in time. Process measurements can be developed for a variety of applications such as, but not limited to, corrective action, design, programming standards, unit testing, or integration testing, and QA audits.

4.22. Product Audits. There are three prime areas in SQA considered candidates for product audits: documentation, code, and testing.

4.22.1. Documentation. When the QAR has QA responsibility (DD Form 1423, **Contract Data Requirements List**, block 7 or 8 indicates Government contract QA at source is required), verification of deliverable data items is considered to be a product audit.

4.22.2. Code. The QAR should verify conformance to language constructs, to header identification standards, and to lines of code per module standard.

4.22.3. Testing. "Witnessing of Formal Testing" should be a contracting officer imposed product audit. Formal testing can be defined as a "test conducted according to test plans and procedures approved by the contracting activity and witnessed by an authorized contracting activity representative to show that the software satisfies a specific requirement." The QAR should choose the point at which to measure the "release quality" of the software product. Since this audit is conducted after the contractor has performed an examination or test, and the purpose of the audit is to confirm the adequacy of the contractor's testing, the audit yield should be 100 percent conforming. All other QAR testing evaluations should be determined by contractor process measurement points. The QAR should select the Government audit points, how to measure the process, and what contractor data is required to determine acceptability. The QAR should verify the contractor's control of test configurations and the ongoing ability to integrate modules and form test builds.

Section 4E—Courseware and Academic Instruction

4.23. Overview:

4.23.1. This section is designed to provide guidance in establishing a Government contract QA program for monitoring courseware and academic instruction. Government contracts for training systems may require the contractor to develop new courseware or to provide instruction from existing Air Force courseware.

4.23.2. Courseware consists of instructional materials required to support training across all media, including academic media, simulators, and other training devices, and the aircraft. Courseware may reside in a variety of media including video and audio cassettes, floppy diskettes, video discs, or course documents and material.

4.23.3. Academic media consist of slides, tapes, or other audiovisual equipment; computer hardware and software; and communications systems and peripheral equipment necessary to support the development and presentation of cognitive and procedural training. Contractor provided training is both knowledge based and performance based and includes slides, tapes, lessons, workbooks, mediated interactive lectures or instructor-guided reviews, computer based training, and hands-on events in a variety of training devices.

4.24. Courseware Development. Contract requirements for developing new courseware should be determined. Production standards and delivery schedules for new courseware are included in the data requirements and DIDs, and are normally approved by the Government before the final course and lesson development phase. These standards describe how the courseware is to be built and is further clarified below.

4.24.1. Functional Configuration Identification. The functional configuration identification for courseware is established by task listings or the objectives hierarchies report and describes the building blocks on which the Instructional System Development (ISD) process is based. This report provides the model for curriculum and lesson design.

4.24.2. Allocated Configuration Identification. The allocated configuration identification for courseware is described in a media selection and syllabus report and documents the requirements for the design of each course and establishes the numbering system used to identify the CI. This report provides sufficient detail to describe the objectives for each lesson.

4.24.3. Product Configuration Identification. The product configuration identification for courseware is documented in lesson specifications that define individual lesson characteristics.

4.24.4. QA Plan, CM Plan, and ISD Plan. The QA Plan, CM Plan, and ISD Plan define the controls imposed on ISD during the development, production, and maintenance phases. QARs should:

4.24.4.1. Ascertain what measurements or indicators the contractor is using to determine that standards and schedules are being met.

4.24.4.2. Verify the indicators are valid measures of performance and progress.

4.24.4.3. Document any discrepancies or concerns.

4.24.5. Corrective Action. QARs should initiate CARs when accepted standards (ISD Plan, QA Plan, CM Plan, objectives and hierarchies report, media selection and syllabus report, lesson speci-

cations, etc.) are not being followed, and notify the PO, the major command program manager, and contracting office if the schedule may not be met. Before notifying the contracting office, the QAR should determine if there are extenuating circumstances (such as regulation changes, TO updates, safety supplements, changes in operational requirements, changes in prerequisites or student population, etc.) beyond the contractor's control that may be affecting the courseware production schedule. If so, the QAR should consult with the ACO and provide written notice to the ACO, if appropriate. An analysis and recommendation should accompany the notification.

4.24.6. Course Readiness Review (CRR). The contract should define the Government's requirements for determining when the courseware is ready to be taught to students. This activity is called a CRR. Following successful CRR, the contractor assumes full responsibility for delivering instructions to Air Force students. During the development phase, the QAR should determine if the contractor has developed a courseware validation program (such as individual or group tryouts) that demonstrates the course meets intended objectives. Government evaluators should monitor and assess the courseware validation process. Additionally, QARs should verify the following:

- 4.24.6.1. The Government has reviewed the course and concurs it is ready for CRR.
- 4.24.6.2. The contractor has successfully completed the predefined validation process that may include recommended corrections or changes.
- 4.24.6.3. The course is baselined and placed under the appropriate level of CM according to the CM Plan.
- 4.24.6.4. Instruction facilities, training devices, and supporting equipment are ready for student training.
- 4.24.6.5. Qualified instructors meet any unique requirements specified and are ready to teach.

4.25. Academics and Instruction:

4.25.1. The contract or system specification describes the qualification requirements for the contractor's instructor staff. The contractor should have established procedures for determining instructor qualifications and an instructor training and evaluation program. The QAR should evaluate these procedures and periodically perform audits to ensure the continued professionalism of the instructor staff.

4.25.2. Government evaluators should periodically assess the performance of instructors in the training environment independent of contractor evaluations. Excessive evaluations should be avoided, however, because they can be detrimental to the instructor staff. Evaluations should be conducted in concert with the contractor's evaluation program. Evaluators should keep in mind that instruction is an individual process and instructor materials are to be used as guides. The objective is to make sure all course objectives are taught and that the student is effectively trained.

4.25.3. The QAR should review student performance records to detect any positive or negative trends in the contractor's training program. Student critiques and feedback from instructors, graduates, and graduate supervisors are excellent sources of information to detect problem areas and should be considered in selecting or scheduling assessments in academics; however, the QAR should assess all areas periodically regardless of feedback data.

4.25.4. The contract should require the contractor to establish evaluation systems demonstrating the effectiveness and efficiency of the training. Normally, the contractor's test and evaluation staff and the QA staff are tasked to perform this function. Typically, these programs are called Formative Eval-

uation (during courseware development phase), Summative Evaluation (during initial training phase), and Operational Evaluation (during revision and maintenance phase). The QAR should evaluate the adequacy of these processes to satisfy these requirements and verify and analyze the accuracy and validity of the data.

4.25.5. The QAR should analyze all appropriate data to determine if the evaluation system, indicators, and performance records are providing a consistent representation of the training program. If inconsistencies become apparent, the QAR should analyze the data to determine where the inconsistency lies and inform the contractor that a segment of the measurement system is not reflecting an accurate status. The QAR should support this claim with verifiable data.

4.25.6. Master library operations are critical to the distribution of essential documentation to applicable locations. The QAR should periodically audit the master library and course materials for currency, legibility, reproduction quality, etc., to make sure reliable procedures are established to keep all locations current.

4.25.7. An integral part of some training systems is the administrative support system for students. The QAR should periodically audit registrar procedures to make sure appropriate needs of the student are met and any negative aspects affecting training effectiveness are identified.

Section 4F—Hardware Maintenance

4.26. Overview. This section provides guidance to QARs relative to Government contract QA actions to be applied to locations that require a contractor to maintain hardware. These types of contracts normally provide training devices to the contractor as Government-furnished equipment.

4.27. Procedures, Processes, and Records:

4.27.1. Rework and Repair. QARs should make sure the hardware quality and reliability do not become degraded with substandard parts or unauthorized repairs. To maintain integrity of the baseline configuration, QARs should make sure replacement parts are interchangeable and substitutable. QARs should proof contractor maintenance standards by comparing them to drawing specifications. Additionally, completed maintenance should be periodically verified to ensure compliance with approved standards.

4.27.1.1. For example, the contract or drawing for a printed circuit board (PCB) calls out a TO 00-25-234 soldering requirement. QARs should proof the contractor's maintenance standard for soldering on PCBs by comparing it to the TO 00-25-234 requirements. Some actual soldering should then be verified for conformance to the standard.

4.27.1.2. It is important for QARs to understand the difference between rework, repair, and standard repair.

4.27.1.2.1. Rework. A procedure applied to a nonconformance that will completely eliminate it and result in a characteristic that conforms completely to the drawings, specifications, or contract requirements; e.g., removing and replacing an integrated circuit on a PCB.

4.27.1.2.2. Repair. Reduces but does not completely eliminate a nonconformance. The purpose of the repair is to reduce the effect of the nonconformance. Repair is distinguished from rework in that the characteristic after repair still does not completely conform to applicable

drawing, specifications, or contract requirements; e.g., replacing burned off solder traces with jumper wires.

4.27.1.2.3. **Standard Repair Procedure.** A documented repair technique that has been demonstrated to be an adequate and cost-effective method for repair of a type of nonconformance. Standard repair procedures are developed by the contractor and approved by the Government.

4.27.2. Review of Contract Requirements. QARs should review the contractor's logistic support procedures and actual purchase orders for compliance with contract requirements. For example, a drawing specifies a quarter watt resistor rated at 50 ohms, with a tolerance of plus or minus 1 percent. The purchase order should be for a part with these specifications or an approved or authorized substitute. QARs should make sure the contractor is authorized to purchase substitute parts (equivalent or better).

4.27.3. Periodic Maintenance Inspections (PMI). QARs should make sure the PMIs prescribed by the equipment technical manuals are accomplished when required. The PMI due dates and completion dates are normally recorded in AFTO Forms 781, **AFORM Aircrew/Mission Flight Data Document**, or equivalent. QARs should witness these inspections to make sure they are performed according to the equipment's technical manuals. After QARs have established confidence in the contractor's performance, a periodic review of the records should be sufficient.

4.27.4. Maintenance Records. The contractor's records of pending, in process, and completed maintenance activities are documented on some type of maintenance records (work orders, failure reports, AFTO Forms 349, **Maintenance Data Collection Record**, etc.). The contract may specify the format or the contractor may use his own forms. These records should be periodically audited for the following:

4.27.4.1. Are the records complete and accurate?

4.27.4.2. Are any trends developing? For example:

4.27.4.2.1. Increasing failure rates for specific equipment (degradation of reliability).

4.27.4.2.2. Increasing number of overdue PMIs.

4.27.4.2.3. Increasing amount of downtime or response time.

4.27.4.2.4. Increasing number of items awaiting parts.

4.27.4.2.5. Increasing number of items awaiting maintenance.

4.27.4.2.6. Increasing backlog of maintenance records.

4.27.4.2.7. Increasing backlog of parts on order.

4.27.4.2.8. Parts on order for excessive length of time.

4.28. Property and Inventory Control System. See paragraph 3.5. for Government contract QA responsibilities.

4.29. Environmental Controls. Computer hardware and training devices have specific environmental requirements (temperature and humidity) that are found in the equipment's TOs or manuals. QARs should periodically audit the contractor's records to make sure environmental conditions are maintained.

4.30. Safety and Housekeeping. Air Force Occupational Safety and Health standards listed in section I of the contract apply only to the extent of protecting Government resources. Air Force responsibility in contractor operations lies only with the protection of Air Force personnel who work in or around contractor operations and with Government equipment and property. Contractors are solely responsible for compliance with Occupational Safety and Health Act standards and the protection of their employees.

4.31. Training Requirements. The contractor's maintenance technicians should have the skills to maintain the simulator according to contract requirements. Training records should be available to provide objective evidence of completed training. QARs should verify that technicians possess the required skills.

RICHARD E. HAWLEY, Lt General, USAF
Principal Deputy, Assistant Secretary of the
Air Force for Acquisition

Attachment 1

GLOSSARY OF ABBREVIATIONS AND ACRONYMS

Abbreviations and Acronyms

ACO—Administrative Contracting Officer
CAP—Contractor-Acquired Property
CAR—Corrective Action Request
CDRL—Contract Data Requirements List
CI—Configuration Item
CIO—Continuous Improvement Opportunity
CLS—Contractor Logistics Support
CM—Configuration Management
CRR—Course Readiness Review
CSCI—Computer Software Configuration Item
DID—Data Item Description
DoD—Department of Defense
FAR—Federal Acquisition Regulation
ISD—Instructional System Development
IV&V—Independent Verification and Validation
PACO—Primary Administrative Contracting Officer
PCB—Printed Circuit Board
PCO—Procuring Contracting Officer
PMI—Periodic Maintenance Inspection
PO—Project Officer
QA—Quality Assurance
QALI—Quality Assurance Letter of Instruction
QAR—Quality Assurance Representative
ROM—Read Only Memory
RSP—Recompetition Support Package
SACO—Support Administrative Contracting Officer
SCM—Software Configuration Management
SD—Software Development
SOW—Statement of Work

SQA—Software Quality Assurance

TO—Technical Order

TSSC—Training Systems Support Center

Attachment 2

CATEGORIES, SUBCATEGORIES, AND SUBJECTS

A2.1. Software (Category):

A2.1.1. Development (Subcategory):

- A2.1.1.1. Configuration and library controls.
- A2.1.1.2. Design documentation and design standards (CDRLs).
- A2.1.1.3. Test procedures and test support.
- A2.1.1.4. Data collection and error analysis.
- A2.1.1.5. SQA Plan and corrective action.
- A2.1.1.6. Validation and verification.
- A2.1.1.7. Nondeliverable software and support tools.
- A2.1.1.8. Integration.
- A2.1.1.9. Schedule.

A2.1.2. Maintenance (Subcategory):

- A2.1.2.1. Configuration and library control.
 - A2.1.2.1.1. SQA audits.
 - A2.1.2.1.2. Documentation.

A2.2. Courseware (Category):

A2.2.1. Development (Subcategory):

- A2.2.1.1. Development standards.
- A2.2.1.2. Configuration and library controls.
- A2.2.1.3. Validation.
- A2.2.1.4. Schedule.

A2.2.2. Academic Media and Support Equipment (Subcategory):

- A2.2.2.1. Identification.
- A2.2.2.2. Protection.
- A2.2.2.3. Maintenance.
- A2.2.2.4. Disposition.

A2.2.3. Academic Instruction (Subcategory):

- A2.2.3.1. Trained qualified instructors.
- A2.2.3.2. Instructor performance.

- A2.2.3.3. Student performance.
- A2.2.3.4. Student reaction and feedback system.
- A2.2.3.5. Training facilities and training environment.
 - A2.2.3.5.1. Console operations.
- A2.2.3.6. Student scheduling, support, and registrar.

A2.2.4. Technical Accuracy, Content, and Currency (Subcategory).

A2.2.5. Configuration and Library Control (Subcategory).

A2.2.6. Documentation (CDRLs) (Subcategory).

A2.3. Hardware (Category):

A2.3.1. Reliability (Subcategory):

- A2.3.1.1. Unscheduled maintenance.
- A2.3.1.2. Environmental controls.

A2.3.2. Maintainability (Subcategory):

- A2.3.2.1. Scheduled maintenance.
- A2.3.2.2. Maintenance standards and TOs.
- A2.3.2.3. Trained technicians.
- A2.3.2.4. Records.

A2.3.3. Supportability (Subcategory):

- A2.3.3.1. Configuration control.
- A2.3.3.2. Support equipment.
- A2.3.3.3. Calibration.
- A2.3.3.4. Logistics support and purchased parts.
- A2.3.3.5. Receiving.
- A2.3.3.6. Inventory control.
- A2.3.3.7. Status and identification.
- A2.3.3.8. Protection.
- A2.3.3.9. Shipping.
- A2.3.3.10. Disposition.

A2.4. Administration (Category):

A2.4.1. Safety (Subcategory).

A2.4.2. Security (Subcategory).

A2.4.3. Janitorial Services (Subcategory).

A2.4.4. Base Support (Subcategory).

A2.4.5. Contractor Quality (Subcategory).

Attachment 3

NOTATION AND CHECKLIST

	Category	Subcategory	Subject
	Hardware	Maintainability	Scheduled Maintenance
Acceptable (A) or Rejected (R)	Contract Requirement	Description of Task	Contractor Reference
R	SOW 3.3.24	30-day phase	TO XX XXX XXX
A	SOW 3.3.25	60-day phase	TO XX XXX XXX
A	SOW 3.3.25	120-day phase	TO XX XXX XXX
A	SOW 3.3.43	System Diagnostics	TO XX XXX XXX
R	SOW 3.3.45	Preflight	Work Cards 1 through 12
A	SOW 3.3.65	Filter Change	TO XX XXX XXX

This illustration depicts a simple notation and checklist approach to document the examination of data generated for the category "Hardware," the subcategory "Maintainability," and the subject "Scheduled Maintenance." Compliance is shown as acceptable. Noncompliance is shown as rejected. The QAR can prepare this type of checklist in as much detail as needed to demonstrate the contractor has imposed measurements within a process or has sufficient documentation that provides verification that the specific task is conducted according to contract requirements.