Audit Report

OFFICE OF THE INSPECTOR GENERAL

STATISTICAL PROCESS CONTROL AT MCDONNELL DOUGLAS HELICOPTER SYSTEMS

Report No. 95-044

November 28, 1994

Department of Defense

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Acronyms

AMCCOM	Armament, Munitions, and Chemical Command
ATCOM	Aviation and Troop Command
DLA	Defense Logistics Agency
DPRO	Defense Plant Representative Office
OIG	Office of the Inspector General
SPC	Statistical Process Control

INSPECTOR GENERAL
DEPARTMENT OF DEFENSE
400 ARMY NAVY DRIVE
ARLINGTON, VIRGINIA 22202-2884

November 28, 1994

MEMORANDUM FOR DIRECTOR, DEFENSE LOGISTICS AGENCY
AUDITOR GENERAL, DEPARTMENT OF THE ARMY

SUBJECT: Audit Report on Statistical Process Control at McDonnell Douglas Helicopter Systems (Report No. 95-044)

We are providing this audit report for review and comments. The report discusses the negotiation of contract requirements for and the implementation of a statistical process control system at McDonnell Douglas Helicopter Systems. This report resulted from a draft finding on the implementation of a contractually required statistical process control system at the McDonnell Douglas Helicopter Systems Mesa facility. The finding was deleted from Inspector General, DoD, Report No. 94-043, "Military Specifications for Critical Threaded Products," February 24, 1994, to provide time to analyze additional data submitted by the contractor and the Defense Plant Representative Office at the Mesa facility and to meet a March 1, 1994, reporting deadline on critical class 3 threaded products to the House Committee on Armed Services.

DoD Directive 7650.3 requires that audit recommendations be resolved promptly. We revised draft Recommendations 1.a. and 2.a. after considering Army and Defense Logistics Agency comments on a draft of this report. Therefore, we request that the Army and the Defense Logistics Agency provide additional comments on the unresolved recommendations by January 27, 1995.

We appreciate the courtesies extended to the audit staff. If you have any questions on this audit, please contact Mr. Richard B. Jolliffe, Audit Deputy Director, at (703) 604-9202 (DSN 664-9202), or Mr. Timothy J. Staehling, Audit Project Manager, at (703) 604-9256 (DSN 664-9256). Appendix D lists the distribution of this report. The audit team members are listed inside the back cover.

Robert J. Lieberman
Assistant Inspector General
for Auditing

Office of the Inspector General, DoD

Report No. 95-044 **November 28, 1994**
(Project No. 3CA-5010.01)

STATISTICAL PROCESS CONTROL AT MCDONNELL DOUGLAS HELICOPTER SYSTEMS

EXECUTIVE SUMMARY

Introduction. This audit of the statistical process control system implementation at McDonnell Douglas Helicopter Systems, Mesa, Arizona, resulted from a previous review of military specifications for critical class 3 threaded products. This report resulted from a draft finding on the implementation of a contractually required statistical process control system at the McDonnell Douglas Helicopter Systems Mesa facility. The finding was deleted from Inspector General, DoD, Report No. 94-043, "Military Specifications for Critical Threaded Products," February 24, 1994, to provide time to analyze additional data submitted by the contractor and the Defense Plant Representative Office at the Mesa facility and to meet a March 1, 1994, reporting deadline on critical class 3 threaded products to the House Committee on Armed Services.

Objectives. The original audit objectives were to determine whether contracting officers were properly including the most recent military specifications for class 3 threaded products in aerospace production and spare parts contracts and to assess how selected prime contractors applied the revised military specifications. The statistical process control system at McDonnell Douglas Helicopter Systems was reviewed as part of the original objectives. The original audit objectives were expanded to include an assessment of the negotiation of the contract requirements for the implementation of and the administration of the McDonnell Douglas Helicopter Systems statistical process control system at the Mesa and the Culver City, California, facilities. The audit also evaluated the effectiveness of internal controls applicable to the expanded objectives.

Audit Results. At its Mesa facility, McDonnell Douglas Helicopter Systems had only partially implemented a contractually required statistical process control system. Further, Apache helicopter contracts negotiated by the Army Aviation and Troop Command did not describe when the statistical process control system was to be implemented or how an implemented system was to be reported. As a result, the Government cannot take full advantage of the benefits derived from a statistical process control system for the $4.4 million in statistical process control system funds expended on the AH-64 Apache attack helicopter.

Internal Controls. No material internal control weaknesses applicable to the audit objectives were identified at the Army Aviation and Troop Command. However, the audit identified material internal control weaknesses at the Defense Plant Representative Office at McDonnell Douglas Helicopter Systems. The internal controls at the Defense Plant Representative Office were not effective to verify that a contractually required statistical process control system was fully implemented and operationally effective. See Part I for the internal controls assessed and Part II for details on the weaknesses identified.

Potential Benefits of Audit. DoD will receive either a fully implemented statistical process control system or an equitable adjustment for that portion of the statistical process control system not implemented during AH-64 Apache attack helicopter program years 9 through 11. Appendix B summarizes the potential benefits resulting from the audit.

Summary of Recommendations. We recommend that the Commander, Army Aviation and Troop Command, direct the AH-64 Apache attack helicopter contracting officer to establish a separate contract line item requirement for a statistical process control system in program year 12 modifications and any other efforts negotiated with McDonnell Douglas Helicopter Systems. We also recommend that the Defense Contract Management Command require McDonnell Douglas Helicopter Systems to fully implement an operationally effective statistical process control system for the AH-64 Apache attack helicopter program year 12, and that an equitable adjustment be determined for that portion of the statistical process control system not implemented during program years 9 through 11. Additionally, we recommend that the Defense Contract Management Command issue written internal control objectives and verification techniques to validate and support the Government administration and to justify the operational effectiveness of contractually required statistical process control systems.

Management Comments. The Commander, Army Aviation and Troop Command, nonconcurred with the recommendations to establish a separate contract line item requirement for a statistical process control system for program year 12. The Defense Logistics Agency concurred with recommendations to fully implement an operationally effective statistical process control system for program year 12, but nonconcurred with a draft recommendation that an equitable adjustment be determined for that portion of the statistical process control system not implemented during program years 8 through 11. The Defense Logistics Agency agreed that current internal control objectives and verification techniques should be clarified to specifically delineate statistical process control requirements, but stated that the control weaknesses identified at the Defense Plant Representative Office, McDonnell Douglas Helicopter were not material. A summary of management comments is in Part II and the complete text of management comments is in Part IV of the report.

Audit Response. As a result of Army comments, we revised the draft recommendation to state that the recommended contract line item for program year 12 and any subsequent efforts include funds appropriated for maintenance as well as for implementation of the McDonnell Douglas Helicopter statistical process control system. Although the Army stated that mandating McDonnell Douglas Helicopter reporting on statistical process control on any subsequent contract was not cost-effective, the Army provided no data in its response to support such a conclusion.

As a result of Defense Logistics Agency management comments and Office of General Counsel, Office of Inspector General, DoD, comments, we revised the draft recommendation that an equitable adjustment be determined for that portion of the statistical process control system not implemented during program years 8 through 11, to an equitable adjustment for a portion of program year 9 and all of program years 10 and 11. We recognize the difficulty in quantifying the amount and the form of an equitable adjustment. The Defense Logistics Agency failed to provided any information in its management response to refute that the internal control weaknesses at the Defense Plant Representative Office at McDonnell Douglas Helicopter were material. However, corrective action has been taken. We request that the Army and the Defense Logistics Agency provide additional comments on the final report by January 27, 1995.

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This report was prepared by the Contract Management Directorate, Office of the Assistant Inspector General for Auditing, DoD.

Part I - Introduction

Background

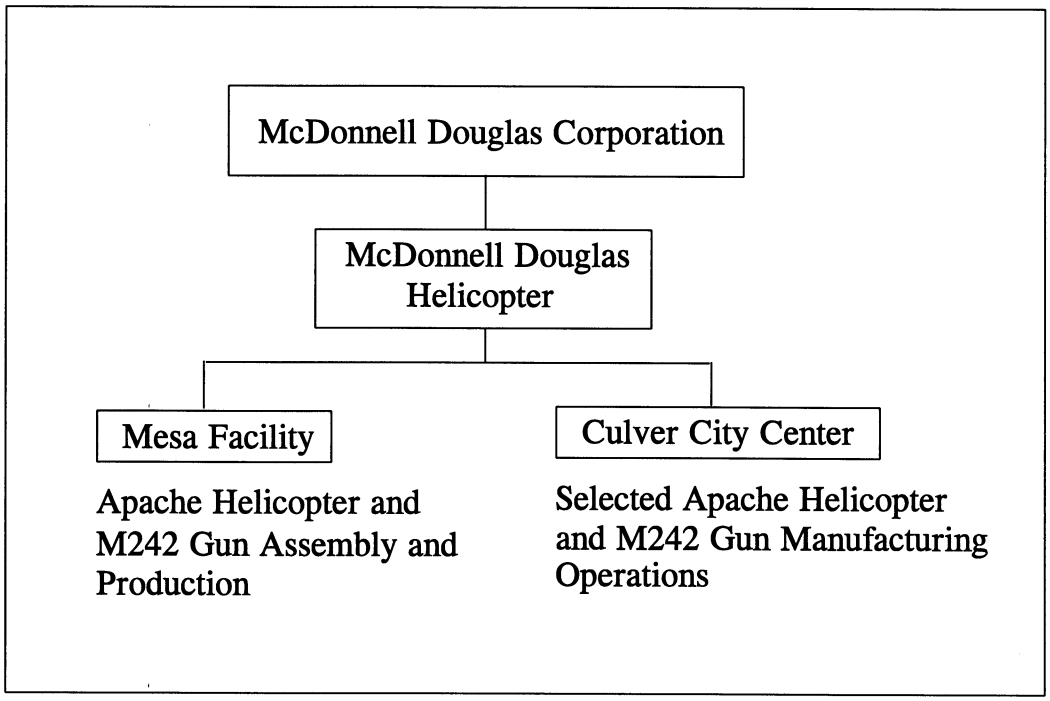
Statistical Process Control System Used to Improve Safety and Reliability. Statistical process control (SPC) is a system used by the prime contractor or subcontractor to manage and improve production performance through quality evaluation during the manufacturing process. An SPC system includes designated parameters with set upper and lower control limits for each production process. A SPC system gives individual machine operators measuring methods to maintain product quality, charts variable or attribute data for each production component cycle, and signals warnings when parameters go beyond predefined boundaries. Therefore, SPC gauges the performance of the manufacturing process by carefully monitoring changes in the product being produced.

According to the definition of SPC, an effectively implemented SPC system should include the ability to measure the average and variability of any given characteristic within a contractor area, department, part, or process. The SPC system would apply to, but not be limited to, machine shops, bonding processes, heat treating, and assembly processes. SPC techniques should include control charts and control limits. A properly implemented SPC system should improve manufacturing yield, while lowering production, inspection, and nonconformance costs. An effectively implemented SPC system can increase the safety and the reliability of the end product.

SPC Provisions Included in Certain DoD Contracts. Certain DoD weapon system production contracts contain quality assurance provisions requiring Defense contractors to use SPC techniques. The methods for including SPC requirements in contracts vary by procuring agency and by contracting officer.

McDonnell Douglas Helicopter Systems Organization. McDonnell Douglas Helicopter Systems (McDonnell Douglas Helicopter) is a division of McDonnell Douglas Corporation, St. Louis, Missouri. McDonnell Douglas Helicopter's primary management, production, assembly, and test facility for the AH-64 Apache attack helicopter (Apache helicopter) is located in Mesa, Arizona. The McDonnell Douglas Helicopter Culver City, California, Manufacturing Center (the Culver City center) performs major manufacturing operations for the Apache helicopter and M242 25mm automatic gun (M242 gun) contracts. The Culver City center manufacturing operations were terminated on July 31, 1994. The Culver City center manufacturing operations were transferred to McDonnell Douglas facilities in Mesa and St. Louis.

The following figure details the McDonnell Douglas Helicopter operating structure as of July 31, 1994.



McDonnell Douglas Helicopter Systems Operating Structure

Objectives

The original audit objectives were to determine whether contracting officers were properly including the most recent military specifications for class 3 threaded products in aerospace production and spare parts contracts and to assess how selected prime contractors applied the revised specifications. The statistical process control system at McDonnell Douglas Helicopter Systems was reviewed as part of the original objectives. The original audit objectives were expanded to include an assessment of the negotiation of the contract requirements for the implementation of and the administration of the McDonnell Douglas Helicopter SPC system at the Mesa and Culver City facilities. The audit also evaluated the effectiveness of internal controls applicable to the objectives.

Scope and Methodology

Initial Review and Expanded Review. We initially reviewed the implementation status of SPC systems at prime contractor locations to assess contractor abilities to perform statistically based sampling of critical class 3 threaded products, as permitted by the revised military specifications. We initially reviewed the McDonnell Douglas Helicopter SPC system in June 1993 as part of our review of military specifications for critical threaded products in Inspector General, DoD, Report No. 94-043, "Military Specifications for Critical Threaded Products," February 24, 1994. Our review of the McDonnell Douglas Helicopter SPC system expanded when Defense Plant Representative Office (DPRO) personnel stated that McDonnell Douglas Helicopter had not fully implemented a contractually required SPC system at its Mesa production, assembly, and test facility. We expanded our review to:

- determine why the SPC system was negotiated and included in the Apache helicopter production contracts,

- determine the present status of SPC application at McDonnell Douglas Helicopter and the history of SPC application since the 1989 negotiation of the SPC clause in the Apache helicopter statement of work requirement, and

- estimate the costs involved to implement SPC at McDonnell Douglas Helicopter.

We interviewed applicable McDonnell Douglas Helicopter corporate managers, assessed local corporate policies and procedures, analyzed judgmentally selected SPC system documentation, and reviewed McDonnell Douglas Helicopter SPC system capabilities and procedures in the assembly, production, and receiving areas. We analyzed documentation dated from 1989 through 1994. Engineers from the Technical Assessment Division, Office of the Inspector General (OIG), DoD, provided technical assistance at the McDonnell Douglas Helicopter Mesa facility. We did not review the SPC system implementation at subcontractor facilities or at satellite McDonnell Douglas Helicopter production facilities because of planned reductions in program workload at the facilities attributable to reduced Apache helicopter production requirements.

The results of our review of the McDonnell Douglas Helicopter SPC system were included in the draft of Inspector General, DoD, Report No. 94-043. We omitted the results from the final report to allow time to analyze additional data submitted by McDonnell Douglas Helicopter and the DPRO at the Mesa facility and to meet a March 1, 1994, reporting deadline on critical class 3 threaded products to the House Committee on Armed Services.

As a result of informal comments made by the Commander, DPRO, at McDonnell Douglas Helicopter, we revisited the Mesa facility in January 1994. Additional data provided by the DPRO and McDonnell Douglas Helicopter have been considered and included in this report.

We selected Apache helicopter production contracts at the Army Aviation and Troop Command (ATCOM) to review the contractual SPC system requirements. We also analyzed applicable proposal and negotiation files covering 1989 through 1993 and interviewed the applicable Government contracting and technical officials responsible for negotiating and applying the SPC system.

We reviewed a contractual SPC system requirement for the M242 gun. We also interviewed applicable contracting and technical officials at the Army Armament, Munitions, and Chemical Command (AMCCOM) responsible for negotiating the contract requirements and for applying the M242 gun SPC system.

Audit Period, Standards, and Locations. We performed this economy and efficiency audit from June 1993 through June 1994 in accordance with auditing standards issued by the Comptroller General of the United States, as implemented by the Inspector General, DoD. Accordingly, we included such tests of internal controls as were considered necessary. We did not rely on any computer-processed data or statistical sampling procedures to perform the audit. Appendix C lists the organizations visited or contacted during the audit.

Internal Controls

Internal Controls Assessed. We evaluated internal controls over SPC system negotiations in Apache helicopter contracts and SPC system implementation at McDonnell Douglas Helicopter. At both ATCOM and the DPRO McDonnell Douglas Helicopter, we analyzed the stated internal control objectives and reviewed the adequacy of the techniques used to accomplish the stated objectives. We also reviewed the portion of the Internal Management Control Program at ATCOM and at the DPRO McDonnell Douglas Helicopter applicable to the audit objectives. We reviewed the established process to include the contracting officers in the SPC system requirements contract negotiations and the established process to assess the implementation of an SPC system.

Adequacy of Internal Controls. The audit identified material internal control weaknesses at the DPRO McDonnell Douglas Helicopter. The internal controls at the DPRO were not effective to verify that an SPC system was fully implemented and operationally effective. Those weaknesses had not been reported under the Internal Management Control Program because SPC implementation was not explicitly covered as an assessable unit. Recommendation 2.b., if implemented, will correct the weaknesses. We could not determine the monetary benefits to be realized by implementing the recommendation because quantifying the future impact of increased safety and reliability resulting from full implementation of SPC is not possible. See Appendix B for a summary of potential benefits resulting from the audit. A copy of the report will be provided to the senior official in charge of internal controls for the Defense Logistics Agency (DLA).

At ATCOM, we did not identify any material internal control weaknesses covering the negotiation of SPC clauses, as our review was limited to only Apache helicopter SPC system contract negotiations.

Prior Audits and Other Reviews

No previous audits or other reviews of negotiation and implementation of SPC systems have been identified.

Part II - Finding and Recommendations

Negotiation and Implementation of Statistical Process Control System

McDonnell Douglas Helicopter did not fully implement a contractually required SPC system at its Mesa facility. The SPC system was not fully implemented because:

- identifiable contractual funding and reporting requirements were not negotiated,

- the resident DPRO did not provide continuous oversight over the implementation of the SPC system, and

- McDonnell Douglas Helicopter managers resisted SPC requirements implementation.

As a result, DoD expended at least $4.4 million in SPC system funds on Apache helicopter contracts without fully gaining the benefits derived from the SPC system.

SPC Contractual Requirements

Contractual requirements for the SPC system at McDonnell Douglas Helicopter are included in ATCOM contracts DAAJ09-89-C-A003 and DAAJ09-92-C-A001 for the Apache helicopter and in AMCCOM contract DAAA09-91-C-0518 for the M242 guns.

- Contracts DAAJ09-89-C-A003 and DAAJ09-92-C-A001 are for program years 8 through 11 domestic and foreign military sales production (deliveries from July 1990 through December 1995) of 302 Apache helicopters. Both Apache helicopter contracts require an SPC system as part of the systems engineering management statement of work.

- The SPC requirements included in AMCCOM contract DAAA09-91-C-0518 were added through modification P00005, June 30, 1992, at a cost of $130,000. Contract DAAA09-91-C-0518 calls for production of 1,125 M242 guns.

The following table shows when ATCOM and AMCCOM added an SPC requirement to each contract.

SPC Requirements Added to Contracts Through Modifications

Contract	Modification	Date SPC Requirements Added to Contract	Program Year
ATCOM			
DAAJ09-89-C-A003* (Apache helicopter)	P00022	Added July 1, 1989	8-9
DAAJ09-89-C-A003 (Apache helicopter)	P00181	Added August 22, 1991	10-11
DAAJ09-92-C-A001* (Apache helicopter)	PZ0001	Added September 4, 1992	11
AMCCOM			
DAAA09-91-C-0518 (M242 gun)	P00005	Added June 30, 1992	Not Applicable

*ATCOM will negotiate an SPC requirement for program year 12 for both contracts in 1995.

SPC System Implementation

McDonnell Douglas Helicopter has not fully implemented a contractually required SPC system at its Mesa facility. DPRO reviews performed in 1990 and 1991 indicated that McDonnell Douglas Helicopter had not implemented an SPC system on the production and assembly lines. OIG, DoD, and other Government engineering reviews performed as part of our audit during 1993 and 1994 continued to find only partial implementation of an SPC system at the McDonnell Douglas Helicopter Mesa facility. See Appendix A for a chronology of SPC events.

OIG, DoD, Engineering Reviews of SPC System. Engineers from the Technical Assessment Division, OIG, DoD, (OIG, DoD, engineers) reviewed the SPC system at the Mesa facility in June 1993 and in January 1994. In June 1993, the OIG, DoD, engineers reviewed SPC functions for the Apache helicopter assembly line and the Apache helicopter cable and wire harness and hydraulic tubing and pipe production areas. After the June 1993 review, the OIG, DoD, engineers stated that they found no evidence that the SPC system was being fully applied in the Apache helicopter assembly and production areas. The OIG, DoD, engineers also determined that McDonnell Douglas Helicopter did not meet the SPC system implementation project schedule milestones for the Apache helicopter assembly. The milestones, which McDonnell Douglas

Helicopter presented on February 6, 1992, to the DPRO at Mesa, called for the completion of Apache helicopter assembly SPC projects by March 30, 1992.

After the January 1994 review, one OIG, DoD, engineer concluded that, while the quality of the cable and wire harness assembly at Mesa was steadily improving with the application of SPC, none of the Apache helicopter assembly operations at Mesa were being monitored using the SPC technique. We concluded after the OIG, DoD, engineer reviews that insufficient evidence of full SPC system implementation existed to support the expenditure of Apache helicopter SPC funds.

McDonnell Douglas Helicopter Mesa SPC Projects. In response to our draft finding, the Commander, DPRO McDonnell Douglas Helicopter, requested a consulting quality assurance engineer (consulting engineer) from another DPRO to review the status of SPC implementation at the Mesa facility. The consulting engineer conducted the review in early January 1994. Reviews conducted by the consulting engineer and the OIG, DoD, engineer indicated that McDonnell Douglas Helicopter discontinued SPC projects and only partially implemented other SPC projects at its Mesa facility.

Evaluation of Active Projects. The McDonnell Douglas Helicopter SPC system at the Mesa facility consists of several "SPC projects." The consulting engineer concluded that, while McDonnell Douglas Helicopter had 11 active SPC projects, the actual use of SPC techniques varied from active use to no use. The consulting engineer noted that McDonnell Douglas Helicopter personnel used a broad definition of SPC project that did not actually require the implementation of process improvement activities normally associated with SPC. The consulting engineer recommended that McDonnell Douglas Helicopter management needed to increase its emphasis on process improvement activities across the Mesa facility, with emphasis on SPC charting methods to monitor variation within processes over time. The OIG, DoD, engineers agreed with the consulting engineer analysis.

Evaluation of Discontinued Projects. The consulting engineer also reviewed 12 discontinued Mesa facility SPC projects dating back to 1989. The consulting engineer was unable to determine the root cause for discontinuance of the SPC projects in the time allotted for the review.

As part of our January 1994 review, we requested McDonnell Douglas Helicopter to list all discontinued SPC projects at the Mesa facility. McDonnell Douglas Helicopter responded that 28 projects had been implemented and discontinued and that 20 of the 28 projects were discontinued because of a management decision that the 20 SPC projects added insufficient value to the monitored process. McDonnell Douglas Helicopter stated that the remaining eight projects were discontinued for a variety of reasons, including unreliable SPC data, personnel shifts, and resolved production problems. Although the contractor maintained file folders for each discontinued SPC project, the file folders did not contain written documentation or analyses supporting the decisions to discontinue the projects.

SPC System at the Culver City Center. McDonnell Douglas Helicopter personnel informed us that SPC processes were effectively applied throughout the Culver City center. Available DLA documentation indicated that the SPC system required by contract DAAA09-91-C-0518 for five M242 gun parts was implemented at the Culver City center, but that the SPC system for Apache helicopter operations was only partially implemented. The DLA quality assurance representative responsible for the Culver City center indicated that the SPC system was implemented for 75 percent of the Culver City center's manufacturing operations, but that McDonnell Douglas Helicopter began dismantling the SPC system at the Culver City center in late 1993. We did not review the SPC system implementation at the Culver City center because of the planned facility closing.

SPC System for the M242 Gun. McDonnell Douglas Helicopter and DPRO personnel stated that SPC projects required by contract DAAA09-91-C-0518 for the M242 gun implemented at the Culver City center were not required for work performed at the Mesa M242 gun assembly facility. McDonnell Douglas Helicopter officials stated that SPC on the M242 gun production would be transferred with the M242 gun production process from the Culver City center to the Mesa facility. The OIG, DoD, engineer visited the Mesa M242 gun assembly facility during January 1994 and found no evidence of any assembly operation being observed or monitored through the application of an SPC system.

Negotiation of SPC Funding and Reporting Requirements

We reviewed all three contracts with SPC clauses applicable to McDonnell Douglas Helicopter. Review of the two Apache helicopter production contracts showed that the contracts:

- contained no separate contract line item to identify SPC funds expended on the contracts,

- did not include SPC implementation schedules or the subcontractors subject to the SPC requirement, and

- did not describe how an implemented SPC system was to report SPC data to the Government.

In addition, internal controls at ATCOM were not effective to include a clearly delineated SPC program on the Apache helicopter contracts. As a result, DoD does not have assurance that the SPC system was in place to enhance the safety and reliability of the Apache helicopter. However, unlike the Apache helicopter contracts, the M242 gun contract negotiated by AMCCOM included a much more detailed contractual SPC requirement.

ATCOM Negotiation of the Apache Helicopter SPC. SPC was negotiated in spring and summer 1989 as part of the definitization of the quality assurance

portion of the Apache helicopter program years 8 and 9 system support line items of contract DAAJ09-89-C-A003. SPC funds were included in program system support line item totals. SPC was to be implemented on the Apache helicopter contracts through the statement of work and through a tailored version of MIL-STD-1520C, "Corrective Action and Disposition System for Nonconforming Material."

McDonnell Douglas Helicopter provided the ATCOM negotiator with SPC engineering labor estimates and a 1-year implementation schedule ending in August 1990. The labor estimates and schedules were included in submittals covered by a McDonnell Douglas Helicopter certificate of current cost or pricing data executed on November 17, 1989. An unsigned February 9, 1990, ATCOM memorandum for record indicated that McDonnell Douglas Helicopter agreed to a 180-day SPC implementation period starting January 1, 1990. In addition, the ATCOM memorandum included a list of 13 potential subcontractors subject to SPC requirements. However, the implementation schedules and the requirement for subcontractors to implement an SPC system were not included in the contractual SPC clause or in the tailored MIL-STD-1520C.

Additional SPC negotiations took place from March through July 1991 as part of McDonnell Douglas Helicopter sustaining program system support efforts for program years 10 and 11. The 1991 negotiations resulted in an identical SPC clause being added for program years 10 and 11. The clause was later included in program year 11 requirements for the Apache helicopter foreign military sales contract DAAJ09-92-C-A001.

ATCOM Internal Controls for SPC Negotiation. Internal controls at ATCOM were not effective to include a clearly delineated SPC program on the Apache helicopter contracts. However, the internal control weaknesses at ATCOM were determined not to be material, as our review included only Apache helicopter SPC system contract negotiations. ATCOM lacked adequate internal controls to verify that the contracting officers and program managers responsible for the Apache helicopter contracts were informed of the results of the SPC negotiations. In addition, internal controls were not effective to include a contract line item detailing funds appropriated for the implementation of the contractual SPC program. As a result, the Apache helicopter contracts awarded did not incorporate a clear SPC implementation and reporting requirement.

ATCOM Response on SPC Negotiation. The ATCOM SPC negotiator disagreed that the contract negotiations for SPC requirements resulted in an SPC system that could not be tracked or fully implemented. The ATCOM SPC negotiator stated that no contract line item or data requirement had been included in the contract because SPC was viewed as only a management tool to control operations. In addition, McDonnell Douglas Helicopter wished to maintain selective use of the SPC system to control and validate product quality. The ATCOM SPC negotiator considered the SPC proposal data provided by McDonnell Douglas Helicopter during the negotiations to be sufficient.

The ATCOM acting commander stated that SPC was a very small part of a lengthy statement of work, and the ATCOM acting commander believed that accounting for SPC costs in a separate contract line item was not advisable. The ATCOM acting commander believed that making every piece of work a separate contract line item would result in an extremely unwieldy contract with hundreds of line items. The ATCOM acting commander also believed that no value would be added by retroactively changing contracts in which the period of performance had already been completed.

AMCCOM Negotiation of the M242 Gun SPC. Unlike the Apache helicopter contracts, the AMCCOM M242 gun contract DAAA09-91-C-0518 included a much more detailed contractual SPC requirement. Modification P00005 included a general SPC plan combined with a specific M242 gun SPC memorandum of agreement between the contractor and AMCCOM. The M242 gun contract required that SPC be applied to five M242 gun production parts. A contractual data requirements list included an SPC implementation schedule and milestone dates. The $130,000 implementation cost was amortized over each contract line item.

AMCCOM actively participated in the implementation of the SPC system contractual requirements. AMCCOM validated the implementation of the detailed sections of the SPC plan for the M242 gun through three AMCCOM visits to the Culver City center. AMCCOM delegated SPC general plan oversight responsibility to the DPRO at the McDonnell Douglas Helicopter Mesa facility.

AMCCOM personnel were unaware of any SPC system problems at the Mesa facility, but once aware, did not notice any affect that SPC problems may have had on the M242 gun SPC projects. We concluded that, compared with ATCOM, AMCCOM had done an excellent job in negotiating the SPC contract requirements and implementing an SPC system for the M242 gun.

OIG, DoD, Opinion on SPC Negotiation. We believe that the estimated $22.2 million in proposed Apache helicopter SPC costs (see the SPC Cost Expenditure section later in the finding) warranted the negotiation of a separate contract line item, detailing the funds appropriated and detailing a contract data requirement item including specific SPC reporting requirements. We believe that SPC can still be made directly applicable to contract DAAJ09-89-C-A003 negotiations for program year 12 system support, for ongoing efforts for contract DAAJ09-92-C-A001, and for any future negotiated SPC efforts with McDonnell Douglas Helicopter.

DPRO Oversight of SPC System Implementation

The DPRO did not provide continuous oversight for the SPC system implementation. DPRO quality assurance specialists conducted reviews in 1990 and 1991 that were highly critical of McDonnell Douglas Helicopter attempts to implement a functional SPC system. In late 1991, the DPRO administrative

contracting officer attempted to get McDonnell Douglas Helicopter to achieve full SPC implementation at the Mesa facility. However, we found no evidence that DPRO management performed meaningful oversight reviews to determine the status of SPC system implementation at the Mesa facility since early 1992.

DPRO Administrative Contracting Officer Demand Notice to Implement SPC. On November 15, 1991, the Apache helicopter DPRO administrative contracting officer issued a "Notice of Intent to Issue a Demand" concerning the status of the SPC system. The notice requested the contractor to show why the SPC system had not yet been implemented or to refund an estimated $3.9 million for contract DAAJ09-89-C-A003 (program years 8 and 9) SPC system costs. On December 13, 1991, McDonnell Douglas Helicopter responded to the DPRO administrative contracting officer, rejecting the premise that the contractual SPC had not been implemented.

Revised SPC Implementation Plan. On February 6, 1992, DPRO management met with McDonnell Douglas Helicopter officials concerning SPC implementation status. McDonnell Douglas Helicopter responded on February 21, 1992, with a revised implementation plan and related program briefing materials. The revised plan established October 1992 as the new SPC implementation milestone. The DPRO administrative contracting officer concurred with the revised plan in an April 3, 1992, letter to McDonnell Douglas Helicopter.

McDonnell Douglas Helicopter also prepared an SPC manual in March 1992, which was accepted by DPRO technical specialists on June 24, 1992. The manual described all aspects of the SPC process in detail, including SPC project plans, process documentation, and corrective action techniques. DPRO management noted that the contents of the manual and the revised plan had been worked out with the DPRO in the February 1992 meetings. However, DPRO management could provide no workpapers or analyses supporting the acceptance of the SPC manual or revised plan. Nor could we locate any document that described oversight of the contractor SPC system by the Government after the submittal of the revised plan and manual.

DPRO Followup to Revised SPC Implementation Plan. By June 1993, the DPRO administrative contracting officer who concurred with the McDonnell Douglas Helicopter revised plan relocated to a new position at another DLA office, and no further DPRO requests for, or submissions of, SPC system documentation were made. The newly assigned DPRO administrative contracting officer was not familiar with the status of the SPC system implementation program at the McDonnell Douglas Helicopter Mesa facility. However, DPRO quality assurance personnel continued to state to us in interviews that McDonnell Douglas Helicopter had not fully implemented the SPC system at the Mesa facility.

Internal Controls for SPC Implementation. The internal control systems for quality assurance at the DPRO were not effective to verify that an SPC system was fully implemented and operationally effective. SPC implementation was not listed as a program or function subject to a vulnerability assessment for any of the three DPRO quality assurance branches. As a result, the Government did

not receive the assurance that the SPC program added any value to the safety and reliability of the Apache helicopter for the SPC system funds expended. We believe that written internal control objectives and verification techniques are needed to verify that contractual SPC systems are fully implemented and operationally effective.

DPRO Response on SPC Implementation. The DPRO commander stated that the DPRO was responsible for maintaining oversight of the SPC system and disagreed that DPRO management had not followed up on previous attempts to achieve implementation or to recover SPC costs. However, the DPRO commander could not provide any written documentation to support any DPRO evaluation of the SPC system after McDonnell Douglas Helicopter submitted the revised SPC plan and manual in 1992. The DPRO commander also:

- stated that McDonnell Douglas Helicopter generated quarterly SPC system reports, but that McDonnell Douglas Helicopter did not provide the reports to the DPRO because the contract did not contain a requirement to submit SPC data,

- agreed that the SPC statement of work could have been more clearly defined in the original negotiation and that the lack of contractual line items and data requirements could have hampered the DPRO administration of the SPC requirement,

- believed that McDonnell Douglas Helicopter experienced difficulty and delays in SPC implementation, and

- believed that tracking McDonnell Douglas Helicopter SPC expenditures did not appear to be possible.

Other DPRO management representatives repeatedly emphasized that McDonnell Douglas Helicopter had met contractual SPC requirements or that the SPC statement of work did not require any deliverables from McDonnell Douglas Helicopter. The fact still remains that the Government paid at least $4.4 million for full implementation and compliance by mid-1990 with the stated SPC requirements.

ATCOM Response on SPC Implementation. ATCOM personnel were initially unaware of McDonnell Douglas Helicopter's failure to fully implement an SPC system at the Mesa facility. Discussions with former and current ATCOM Apache helicopter contracting officers indicated no awareness of the ongoing or past SPC system implementation difficulties. The deputy Apache helicopter program manager stated that all approval or review authority over the SPC system implementation had been delegated to the DPRO.

The ATCOM SPC negotiator commented that ATCOM had not reviewed the implementation of the SPC system at the Mesa facility since an August 1990 product assurance review. The August 1990 product assurance review stated that McDonnell Douglas Helicopter had provided plans, procedures, and program implementation documentation. The ATCOM SPC negotiator stated that the change of cognizance in 1990 from the Army Plant Representative

Office to the DLA DPRO resulted in delegation of SPC oversight to the DPRO. However, the ATCOM SPC negotiator in fall 1991 subsequently assisted the DPRO administrative contracting officer in calculating the amount of negotiated SPC system costs associated with the Apache helicopter program.

OIG, DoD, Opinion on SPC Implementation. Contractor implementation of the SPC requirements before 1992 was marginal at best. Recent reviews performed during 1993 and 1994 continue to find only partial implementation of an SPC system. Thus, the Government has never received assurance of an operationally implemented SPC system for the funds expended. However, comments offered by the Office of General Counsel, OIG, DoD, indicated that the April 3, 1992, DPRO administrative contracting officer acceptance of the revised SPC implementation plan precludes any request for equitable adjustment for that portion of the SPC system that McDonnell Douglas Helicopter did not implement during program year 8 and a portion of program year 9. We believe that an equitable adjustment should be determined for that portion of the SPC system that McDonnell Douglas Helicopter did not implement during the remainder of program year 9 through program year 11. We recognize the difficulty in quantifying the amount and the form of an equitable adjustment.

McDonnell Douglas Helicopter Resistance to SPC

DPRO reviews indicate that McDonnell Douglas Helicopter managers resisted implementation of the SPC requirements before 1992.

DPRO 1990 SPC System Implementation Reviews. In June and July 1990, the DPRO Quality Assurance Division reviewed the initial implementation of the McDonnell Douglas Helicopter SPC system. DPRO found the McDonnell Douglas Helicopter SPC implementation plan and company SPC procedures unacceptable. DPRO quality assurance specialists stated in written reviews that the SPC procedures had no substance and that some McDonnell Douglas Helicopter production line managers were placing schedule in front of quality and lacked commitment to SPC. As a result, McDonnell Douglas Helicopter delayed implementation of the negotiated SPC system schedule from July 1990 until the revised SPC implementation schedule was submitted in February 1992.

DPRO 1991 SPC System Implementation Reviews. In April 1991, DPRO quality assurance specialists again reviewed the McDonnell Douglas Helicopter SPC system at the Mesa facility. The DPRO review concluded that the SPC system implementation was still unacceptable. The DPRO review stated that, while McDonnell Douglas Helicopter submitted SPC system plans and programs to the DPRO, no actual floor-level implementation was evident. The DPRO review noted that no McDonnell Douglas Helicopter management plan, commitment, or procedure for implementing the SPC system yet existed.

In December 1991, four DPRO quality assurance specialists each reviewed a separate McDonnell Douglas Helicopter Mesa facility production or assembly operation. In separate reports to DPRO management, three of the four quality

assurance specialists found that SPC had not been fully implemented in their areas of review. One quality assurance specialist noted in his report that SPC data collection was sporadic and unreliable. A second quality assurance specialist stated that McDonnell Douglas Helicopter personnel did not understand what SPC was or why it was required and were reluctant to implement the contract requirements of SPC. The third quality assurance specialist noted that McDonnell Douglas Helicopter did not have a complete grasp of what benefits the company could receive from a good SPC system. DPRO quality assurance specialists continued to express much the same sentiments when we interviewed them in June 1993.

McDonnell Douglas Helicopter Response. McDonnell Douglas Helicopter SPC personnel stated that they believed that the SPC system at both the Mesa and Culver City center facilities met all the requirements of the contractual SPC statement of work. However, McDonnell Douglas Helicopter management did not dispute the absence of a fully implemented SPC system at the Mesa facility. McDonnell Douglas Helicopter management and SPC personnel stated that the Culver City center was the primary SPC system cost generator and implementation facility.

At our request, McDonnell Douglas Helicopter provided cost data indicating that $39.6 million in direct and indirect funds had been expended by the contractor for the "quality organization" function at all plant locations on the Apache helicopter production contracts during FYs 1989 through 1993. However, McDonnell Douglas Helicopter officials stated that quality control costs attributable to SPC could not be identified or tracked because the contract did not require SPC costs to be segregated at the task level.

McDonnell Douglas Helicopter SPC Training. McDonnell Douglas Helicopter provided to OIG, DoD, unsigned summary data stating that a total of 7,144 hours of SPC training had been provided to 624 company personnel at the Mesa and Culver City center locations since 1989 (an average of 11.4 hours per person). The total of 624 personnel consisted of 275 Mesa and 349 Culver City center personnel.

SPC Cost Expenditures

DPRO and ATCOM contracting and technical personnel identified SPC system costs of $4.4 million for negotiated Apache helicopter program years 8 through 10. Our review of McDonnell Douglas Helicopter proposal documentation, ATCOM pre- and postbusiness clearance memorandums, and Government negotiation notes indicated that the administrative contracting officer estimate of SPC costs may have been understated.

ATCOM Prebusiness Clearance Memorandums. We attempted to isolate the amount of SPC funds expended for program years 8 through 11 on the Apache helicopter contracts. The ATCOM prebusiness clearance memorandums stated that SPC was included within the scope of systems engineering planning and

quality assurance functions. The ATCOM prebusiness clearance memorandum for program years 8 and 9 stated that approximately one-half of all quality assurance systems engineering hours were for implementation of functions related to MIL-STD-1520C. In addition, the same memorandum noted that McDonnell Douglas Helicopter had proposed significant supplier charges to implement MIL-STD-1520C in program years 8 and 9. The ATCOM prebusiness clearance memorandum for program years 10 and 11 indicated that sustaining effort costs for SPC would be maintained at a rate equivalent (per aircraft produced) to program year 9 expenditures.

OIG, DoD, Calculated SPC System Costs. We calculated that McDonnell Douglas Helicopter proposed $22.2 million in SPC-related costs for program years 8 through 11 and that the Government negotiation objective was $9.7 million. We calculated from the Government negotiation objective that the Mesa facility was to receive 44 percent of proposed contractor SPC costs, the Culver City center was to receive 26 percent, and the subcontractors were to receive 30 percent. However, we were unable to identify the amount of SPC costs actually negotiated or distributed because of the commingling of SPC and quality assurance costs with other systems engineering management functions. Final negotiation settlements were made on a bottom-line basis, making the breakout below a contract line item level impossible. A total of $59.8 million was negotiated for systems engineering management functions, of which SPC is a part, for program years 8 through 11.

DPRO Estimated SPC System Costs. The DPRO commander estimated that McDonnell Douglas Helicopter had spent approximately one-quarter of the DPRO estimate of $4.4 million in SPC funding at the Mesa location. The DPRO commander believed that the remainder had been spent at the Culver City center or flowed down to SPC systems at McDonnell Douglas Helicopter subcontractors. The DPRO commander could not provide any written documentation to support the estimate.

Management Comments on the Finding and Audit Response

DLA Comments. DLA agreed that no SPC reporting requirements were delineated in the statement of work to provide for SPC project reporting or to track costs associated with SPC activity. DLA stated that evidence indicated that DPRO oversight of McDonnell Douglas Helicopter SPC activities occurred, but that the DPRO oversight should have been better documented. DLA agreed that DPRO surveillance of the McDonnell Douglas Helicopter SPC system was inadequately defined in the DPRO operating procedures and that DPRO and McDonnell Douglas Helicopter personnel are inadequately trained in SPC techniques. DLA believed that all DPRO SPC program oversight weaknesses were correctable and that additional SPC refresher training is required.

Audit Response. We agree that DPRO oversight of McDonnell Douglas Helicopter SPC activities was not well documented. Although we agree that some DPRO oversight of the SPC system did occur, we continue to believe that DPRO oversight was sporadic at best and contributed to the absence of an implemented SPC system at McDonnell Douglas Helicopter. We agree that DPRO SPC oversight weaknesses are correctable and that additional DPRO SPC surveillance procedures, refresher training, and documentation are required.

Recommendations, Management Comments, and Audit Response

Revised Recommendations. Based on management comments, we revised draft Recommendation 1.a. to state that the recommended line item include funds appropriated for maintenance as well as for implementation of the McDonnell Douglas Helicopter SPC system. Based on comments received from the Office of General Counsel, OIG, DoD, we revised draft Recommendation 2.a. to adjust the program years subject to an equitable adjustment.

1. We recommend that the Commander, Army Aviation and Troop Command, Army Materiel Command, direct that the Army Aviation and Troop Command AH-64 Apache attack helicopter contracting officer negotiate and include in program year 12 modifications to contracts DAAJ09-89-C-A003 and DAAJ09-92-C-A001 and any other subsequent negotiated statistical process control efforts with McDonnell Douglas Helicopter Systems:

a. A separate contract line item detailing funds appropriated for the implementation and maintenance of the statistical process control system.

b. A contract data requirement line item required by the contract delineating specific statistical process control reporting requirements and submissions to implement and monitor the statistical process control system required by the contract.

Army Comments. The Army nonconcurred with draft Recommendation 1.a. The Army stated that the Government-funded effort for the SPC system was complete and that revising the contract to mandate visibility of spending on the SPC system would have no benefit. The Army stated that including SPC requirements as a separate contract line item with a separate price for each item was not an appropriate contracting practice because such a requirement was a management control function and, as such, was not a deliverable item to the Government. The Army also stated that it believed that the inclusion of an SPC requirement as a separate contract line item would be in violation of a June 29, 1994, Secretary of Defense policy statement requiring that DoD program managers use management and manufacturing specifications and standards for guidance only.

The Army nonconcurred with Recommendation 1.b. The Army stated that mandating McDonnell Douglas Helicopter to report on future SPC system activity through a data item to contract DAAJ09-89-C-A003, or any subsequent contract, was not considered cost-effective. The Army stated that requiring McDonnell Douglas Helicopter to produce a deliverable data item was not considered cost-effective when program year 8 was negotiated. The Army also stated that Government funding of SPC implementation had been completed under program years 8 and 9.

Additionally, the Army stated that the program year 12 statement of work will require that McDonnell Douglas Helicopter:

- continue to maintain an SPC system to review manufacturing results as a management process to minimize production problems and

- submit its SPC policy, procedures, and implementation methods to the Government for review and concurrence.

Audit Response. The Army comments were partially responsive. Based on the Army comments, we revised draft Recommendation 1.a. We agree that a separate contract line item detailing funds appropriated for the McDonnell Douglas Helicopter SPC system is unnecessary if no further Government funding is projected. The Army stated that Government funding of SPC implementation had been completed under program years 8 and 9. However, official negotiation files indicated that Government funding for SPC system implementation and maintenance continued through program years 10 and 11 as part of the quality assurance efforts for contract line items 303AD and 403AD for systems engineering management. The Army response is unclear as to the continuance of quality control funding to maintain the SPC system in program year 12 or any other subsequent negotiated SPC effort.

We agree that an SPC system is a management control function and is not, in itself, a deliverable end product. However, this belief does not preclude an SPC system from being separately priced as an individual line item or as a subsidiary contract line item to detail and track appropriated funds. We believe that a subsidiary contact line item can be easily delineated within systems engineering management.

We do not agree that the inclusion of an SPC requirement as a separate contract line item would be a violation of the June 29, 1994, Secretary of Defense policy statement. The policy statement applies to specific military specifications and standards. Although the policy statement might preclude the SPC system from being referred to as part of a tailored military specification in future program years, it would not preclude inclusion of the SPC requirement in the statement of work as a contract line item or as a contract data item.

Although the Army stated that mandating McDonnell Douglas Helicopter reporting on SPC on any subsequent contract was not cost-effective, the Army provided no data in its response to support such a conclusion.

We found no documentation in any official contract negotiation file indicating any consideration or analysis of a data item requirement for SPC system implementation.

We continue to believe that the lack of identifiable contractual funding and reporting requirements was a contributing cause to the lack of a fully implemented SPC system at the McDonnell Douglas Helicopter Mesa facility. Additionally, the Army response does not comment on or refute the finding or its contractual causes. The Army program year 12 statement of work represented a strengthening of contractual language for the SPC system. However, the Army has yet to provide a contractual means to require McDonnell Douglas Helicopter to submit SPC policy, procedures, and reports to the Government for analysis and approval.

We request that the Army provide additional comments in its response to the final report.

2. We recommend that the Commander, Defense Contract Management Command, Defense Logistics Agency:

a. Require that an operationally effective statistical process control system be fully implemented for the AH-64 Apache attack helicopter for program year 12 and that an equitable adjustment be determined for that portion of the statistical process control system that McDonnell Douglas Helicopter Systems did not implement during program years 9 through 11.

b. Issue written internal control objectives and verification techniques to validate and support the Government administration and to justify the operational effectiveness of contractually required statistical process control systems.

DLA Comments. DLA partially concurred with draft Recommendation 2.a. DLA agreed that an operationally effective SPC system should be fully implemented for the AH-64 Apache attack helicopter for program year 12. DLA stated that the SPC system was not very well documented by McDonnell Douglas Helicopter management nor formally verified or documented by the DPRO at McDonnell Douglas Helicopter. However, DLA nonconcurred with the portion of draft Recommendation 2.a. that required an equitable adjustment be determined for that portion of the SPC system that McDonnell Douglas Helicopter Systems did not implement during program years 8 through 11. DLA stated that past and present DPRO administrative contracting officers had determined that McDonnell Douglas Helicopter had met the SPC requirement stated in the contract.

DLA concurred with Recommendation 2.b. DLA agreed that current internal control objectives and verification techniques should be clarified to specifically delineate SPC requirements. DLA stated that the DPRO at McDonnell Douglas Helicopter has revised its management controls to specifically focus on McDonnell Douglas Helicopter's SPC implementation process and to assure that the April 1992 revised SPC implementation plan is followed. DLA stated that it did not consider the internal control weaknesses at the DPRO to be material.

Audit Response. The DLA comments were partially responsive. As a result of the DLA management comments and Office of General Counsel, OIG, DoD comments, we revised draft report Recommendation 2.a. The Office of General Counsel, OIG, DoD, indicated that the April 3, 1992, DPRO administrative contracting officer acceptance of the revised SPC implementation plan waived the Government's right for equitable adjustment for lack of a fully implemented SPC system up to that date. We now recommend an equitable adjustment for only the time period after the April 3, 1992, DPRO administrative contracting officer acceptance. An equitable adjustment for this time period would include the undelivered portion (41 percent) of program year 9, and all of program years 10 and 11. We recognize the difficulty in quantifying the amount and the form of an equitable adjustment.

The DPRO and ATCOM contracting and technical personnel identified negotiated SPC system costs of $4.4 million for Apache helicopter program years 8 through 10. We calculated that $1.8 of the $4.4 million was attributable to the undelivered portion of program year 9 and all of program year 10. DPRO and ATCOM made no estimate for program year 11. We calculated that McDonnell Douglas Helicopter proposed $7.1 million in SPC-related costs attributable to the undelivered portion of program year 9 and all of program years 10 and 11. The Government negotiation objective attributable to this period was $3.6 million. However, we were unable to identify the amount of SPC costs actually negotiated or distributed for the period because of the commingling of SPC and quality assurance costs with other systems engineering management functions. A total of $30 million was negotiated for systems engineering management functions, of which SPC is a part, for the undelivered portion of program year 9, and all of program years 10 and 11.

The DLA response meets the intent of Recommendation 2.b. However, the response fails to indicate the extent of the clarification to current internal control objectives and verification techniques. DLA provided no information in its management response to refute that the internal control weaknesses at the DPRO at McDonnell Douglas Helicopter were material. We continue to believe that the DPRO internal control weaknesses were material; however, the issue is essentially moot because DLA indicates that corrective action has been taken.

We request DLA provide additional comments on Recommendation 2.a. in its response to the final report.

Part III - Additional Information

Appendix A. Chronology of Statistical Process Control Events

1988

June through August — McDonnell Douglas Helicopter provided initial SPC system cost estimating sheets and a flow-down list of 55 subcontractors in response to an ATCOM request for information.

1989

March 28 — SPC system negotiations began between ATCOM and McDonnell Douglas Helicopter as part of the quality assurance portion of the Apache program year 8 and 9 system support line items and negotiations continued through September 1989. (OIG, DoD, calculated that McDonnell Douglas Helicopter proposed $5.4 million in Mesa and Culver City recurring SPC costs and $13.3 million in subcontractor SPC flow down costs. The Government negotiation objective was calculated at $4.3 million for Mesa and Culver City and $2.9 million for the subcontractor flow down.)

April 14 — SPC clause wording was drafted in non-specific language at McDonnell Douglas Helicopter insistence.

July 1 — SPC clause for program years 8 and 9 was added to Apache contract DAAJ09-89-C-A003 statement of work through modification P00022. No implementation schedule was included on the contract. The SPC clause did not include a reporting requirement for SPC system data to the Government.

July 13 — McDonnell Douglas Helicopter proposed a 12-month SPC system implementation schedule for Mesa and Culver City, beginning in September 1989 and ending in August 1990. McDonnell Douglas Helicopter also proposed 62,500 engineering hours for the Mesa and Culver City implementation. McDonnell Douglas Helicopter designated 63 percent of the proposed hours for the Mesa implementation and 37 percent for the Culver City implementation.

1989 (cont'd)	
July 22	Price negotiations were completed for program year 8. No record was found of the final SPC system negotiation settlement amount.
October 11	Price negotiations were completed for program year 9. No record was found of the final SPC system negotiation settlement amount.
November 17	SPC labor estimates and implementation schedules were included in submittals covered by a McDonnell Douglas Helicopter certificate of current cost or pricing data executed on this date.
1990	
February 9	An unsigned ATCOM memorandum for the record indicated that McDonnell Douglas Helicopter agreed to a 180-day SPC system implementation period starting January 1, 1990. In addition, the ATCOM memorandum included a list of 13 potential suppliers subject to SPC system requirements. However, the implementation schedules and subcontractors subject to SPC were not included in the contractual SPC clause or in the tailored MIL-STD-1520C.
June through July	The DPRO Quality Assurance Division reviewed initial implementation of the SPC system. The DPRO concluded that the McDonnell Douglas Helicopter SPC system implementation plan and company SPC system procedures were unacceptable. DPRO analysts stated that the procedures had no substance and that certain McDonnell Douglas Helicopter production line managers were emphasizing schedule over quality and lacked commitment to a SPC system.
August 30	An ATCOM internal memorandum stated that the McDonnell Douglas Helicopter SPC system implementation milestone was revised to December 1991. (This memorandum was the last record of ATCOM involvement in SPC system implementation as all contract administration was transferred to DPRO.)

Appendix A. Chronology of Statistical Process Control Events

1991

March through July	Additional SPC system negotiations took place between ATCOM and McDonnell Douglas Helicopter as part of the McDonnell Douglas Helicopter sustaining program system support efforts for program years 10 and 11. (OIG, DoD, calculated that McDonnell Douglas Helicopter proposed $3.5 million for Mesa and Culver City recurring SPC system costs. No additional subcontractor SPC system flow down costs were proposed. The Government negotiation objective was calculated at $2.5 million for Mesa and Culver City).
April 25	The DPRO quality assurance review concluded that the SPC system implementation was still unacceptable. The report for that review stated that, while McDonnell Douglas Helicopter had submitted SPC system plans and programs, no actual floor-level implementation was evident. The report also noted that no McDonnell Douglas Helicopter management plan, commitment, or procedure for implementing the SPC system existed.
August 22	The SPC system requirements for program years 10 and 11 were added to contract DAAJ09-89-C-A003 through modification 00181. The requirements were identical to program year 8 and 9 contractual requirements. No record of final SPC system negotiation settlement was found.
November 15	The administrative contracting officer issued a "Notice of Intent to Issue a Demand" concerning the status of the SPC system. The notice requested the contractor to show why the SPC system had not yet been implemented or to refund a DPRO estimated $3,878,810 for contract DAAJ09-89-C-A003 (program years 8 and 9) SPC system costs.
December 13	McDonnell Douglas Helicopter responded to the administrative contracting officer by rejecting the premise that the contractual SPC system had not been implemented.
December 19	Four DPRO quality assurance specialists each reviewed a separate McDonnell Douglas Helicopter Mesa production or assembly operation. In separate reports to DPRO management, three of the four quality assurance specialists concluded that the SPC system had not been fully implemented in their areas of review.

1992	
February 6	DPRO management met with McDonnell Douglas Helicopter officials concerning the SPC system implementation status.
February 21	McDonnell Douglas Helicopter responded with a revised SPC system implementation plan and related program briefing materials. The plan established October 1992 as the revised SPC system implementation milestone.
March 16	McDonnell Douglas Helicopter prepared a draft SPC system manual. The manual described all aspects of the SPC system in detail, including SPC system project plans, process documentation, and corrective action techniques.
April 3	The cognizant administrative contracting officer concurred with the revised SPC implementation plan in a letter to McDonnell Douglas Helicopter.
June 24	A DPRO memorandum to McDonnell Douglas Helicopter accepted the SPC system manual. The memorandum was signed by three DPRO technical specialists. DPRO could provide no workpapers or analyses supporting the approval of the SPC manual or revised plan. No documentation of any further DPRO review of the McDonnell Douglas Helicopter SPC system was found.
September 4	ATCOM added the program year 11 SPC system requirement to contract DAAJ09-92-C-A001. McDonnell Douglas Helicopter proposed additional SPC system costs as part of a factored material cost base. No record of the SPC system cost component in the base or final disposition was documented.
1993	
June 21	The OIG, DoD began a limited review of the McDonnell Douglas Helicopter SPC system as part of an audit of military specifications for critical threaded products. The OIG, DoD, review of the SPC system was expanded when DPRO quality assurance personnel stated that McDonnell Douglas Helicopter had not fully implemented the contractually required SPC system at the Mesa facility.

1993 (cont'd)

June 23	Engineers from the Technical Assessment Division, OIG, DoD, reviewed the SPC system at the Mesa facility. The engineers reviewed SPC system functions for the Apache helicopter assembly line and the Apache helicopter cable/harness and hydraulic tubing/pipe production areas. The engineers concluded that they found no evidence that the SPC system was being fully applied in the Apache helicopter assembly and production areas. The engineers also concluded that McDonnell Douglas Helicopter had not met the SPC system implementation project schedule milestones for the Apache helicopter assembly (the milestones, presented to the DPRO on February 6, 1992, called for the completion of Apache helicopter assembly SPC projects by March 30, 1992).
June 25	The results of the OIG, DoD, review were briefed to the DPRO commander by the OIG, DoD, audit team.
November 24	Finding C of the IG, DoD, Project No. 3CA-5010, "Military Specifications for Critical Threaded Products," November 24, 1993, discussed the results of review of SPC at McDonnell Douglas Helicopter.
December 17 and 30	The DPRO commander, in several phone calls to the OIG, DoD, objected to Finding C and stated that he was never briefed on the finding. The commander was provided copies of OIG, DoD, and Defense Contract Management District-West memorandums of the June 25, 1993, briefing to the commander discussing the SPC system finding issue. OIG, DoD, agreed to revisit the Mesa facility to review additional data provided by the DPRO and McDonnell Douglas Helicopter.

1994

January 10	At the request of the DPRO commander, a consulting quality assurance engineer from a different DPRO reviewed the status of SPC system implementation at the Mesa facility on January 5 and 6, 1994. The DPRO engineer concluded that, although the contractor had 11 active "SPC projects," the actual use of SPC techniques varied from active use to no use. The engineer noted that contractor personnel used a broad definition of an "SPC project" that did not actually require the implementation of process improvement activities normally associated with an SPC system. The OIG, DoD, engineers agreed with this analysis.

1994 (cont'd)

January 18	The DPRO informed the OIG, DoD, that DPRO and ATCOM contracting and technical personnel estimated that $4,417,605 of SPC system costs were negotiated for Apache program years 8 through 10.
January 19 and 20	An OIG, DoD, engineer reviewed the SPC system at the Mesa facility. The engineer concluded that, while the cable/wire harness assembly was steadily improving with the application of SPC, none of the helicopter assembly operations were being monitored using the SPC technique. The OIG, DoD, concluded that insufficient evidence of full SPC system implementation existed to support the expenditure of Apache helicopter SPC system funds.
August 24	IG, DoD, Project No. 3CA-5010.01, "Statistical Process Control at McDonnell Douglas Helicopter Systems," August 24, 1994, reports the results of the expanded review of SPC at McDonnell Douglas Helicopter.
September 26 through 29	As a result of IG, DoD, Project No. 3CA-5010.01, Defense Contract Management Command personnel reviewed the DPRO oversight and McDonnell Douglas Helicopter implementation of the SPC system at Mesa. The review noted that DPRO and McDonnell Douglas Helicopter personnel did not properly document SPC projects and did not understand the short term or long term benefits of an SPC program. The review concluded that the SPC system as implemented complied with the vaguely worded contract statement of work. The Defense Contract Management Command headquarters directed the DPRO to increase training in SPC and to improve internal controls over SPC oversight.

Appendix B. Summary of Potential Benefits Resulting From Audit

Recommendation Reference	Description of Benefit	Amount of Benefit
1.a.	Economy and Efficiency. Requires a contract line item to detail funds associated with the SPC system for the Apache helicopter.	Undeterminable.[1]
1.b.	Economy and Efficiency. Requires delineation of specific reporting requirements and submissions to implement and monitor the SPC system.	Undeterminable.[1]
2.a.	Economy and Efficiency. Requires an equitable adjustment for a portion of program year 9, and all of program years 10 and 11, and requires implementation of a fully developed SPC system for program year 12.	Undeterminable.[2]
2.b.	Internal Controls. Requires written objectives and verification procedures for SPC systems.	Undeterminable.[1]

[1]Quantifying the future impact of increased safety and reliability resulting from a clearly defined SPC system is not possible.

[2]The amount and form of equitable adjustment to be realized is to be determined by the Defense Contract Management Command.

Appendix C. Organizations Visited or Contacted

Office of the Secretary of Defense

Deputy Under Secretary of Defense (Acquisition Reform), Washington, DC

Department of the Army

Assistant Secretary of the Army (Research, Development, and Acquisition), Washington, DC
Army Materiel Command, Alexandria, VA
Armament, Munitions, and Chemical Command, Rock Island, IL
Aviation and Troop Command, St. Louis, MO

Defense Organizations

Defense Logistics Agency, Alexandria, VA
Defense Contract Management Command, Alexandria, VA
Defense Contract Management District-West, El Segundo, CA
Defense Contract Management Area Operations, El Segundo, CA
Defense Plant Representative Office McDonnell Douglas Helicopter Systems, Mesa, AZ

Non-Government Organizations

McDonnell Douglas Helicopter Systems, Mesa, AZ
McDonnell Douglas Helicopter Systems, Culver City, CA

Appendix D. Report Distribution

Office of the Secretary of Defense

Under Secretary of Defense for Acquisition and Technology
Under Secretary of Defense (Comptroller)
Director, Defense Procurement
Assistant to the Secretary of Defense (Public Affairs)

Department of the Army

Secretary of the Army
Assistant Secretary of the Army (Financial Management)
Assistant Secretary of the Army (Research, Development, and Acquisition)
Commander, Army Materiel Command
  Commander, Aviation and Troop Command
  Commander, Armament, Munitions, and Chemical Command
Auditor General, Department of the Army

Department of the Navy

Auditor General, Department of the Navy

Department of the Air Force

Auditor General, Department of the Air Force

Defense Organizations

Director, Defense Contract Audit Agency
Director, Defense Logistics Agency
Director, Defense National Security Agency
Inspector General, Central Imagery Office
Inspector General, Defense Intelligence Agency
Inspector General, National Security Agency
Director, Defense Logistics Studies Information Exchange

Non-Defense Federal Organizations and Individuals

Office of Management and Budget
Technical Information Center, National Security and International Affairs Division, General Accounting Office

Chairman and Ranking Minority Member of Each of the Following Congressional Committees and Subcommittees:

- Senate Committee on Appropriations
- Senate Subcommittee on Defense, Committee on Appropriations
- Senate Committee on Armed Services
- Senate Committee on Governmental Affairs
- House Committee on Appropriations
- House Subcommittee on Defense, Committee on Appropriations
- House Committee on Armed Services
- House Committee on Government Operations
- House Subcommittee on Legislation and National Security, Committee on Government Operations

Part IV - Management Comments

Department of the Army Comments

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
WASHINGTON, DC 20310-0103

21 OCT 1994

SARD-PC

MEMORANDUM FOR ASSOCIATE DIRECTOR, AUDIT FOLLOWUP AND COMPLIANCE DIVISION, U.S. ARMY AUDIT AGENCY, ALEXANDRIA, VA 22202-0000

SUBJECT: Department of Defense Inspector General Draft Report, Statistical Process Control at McDonnell Douglas Helicopter Systems, Project 3CA-5010.01 (AMC No. D9317-A)

This office concurs with the attached AMC/ATCOM position on the subject draft report.

LEE THOMPSON
Colonel, GS
Acting Director
for Contracting

Attachment

DEPARTMENT OF THE ARMY
HEADQUARTERS, U.S. ARMY MATERIEL COMMAND
5001 EISENHOWER AVENUE, ALEXANDRIA, VA 22333-0001

REPLY TO ATTENTION OF

AMCIR-A (36-2b) 12 October 1994

MEMORANDUM FOR MR. JOHN BOURGAULT, ASSOCIATE DIRECTOR, AUDIT FOLLOWUP AND COMPLIANCE DIVISION, U.S. ARMY AUDIT AGENCY, ALEXANDRIA, VA 22202-0000

SUBJECT: Department of Defense Inspector General Draft Report, Statistical Process Control at McDonnell Douglas Helicopter Systems, Project 3CA-5010.01 (AMC No. D9317-A)

1. We are forwarding our position on subject report IAW AR 36-2.

2. Point of contact for this action is Mr. Robert Kurzer, (703) 274-9025.

3. AMC -- America's Arsenal for the Brave.

Encl
as

RAY E. McCOY
Major General, USA
Chief of Staff

DEPARTMENT OF THE ARMY
HEADQUARTERS, US ARMY AVIATION AND TROOP COMMAND
4300 GOODFELLOW BOULEVARD, ST. LOUIS, MO 63120-1798

REPLY TO ATTENTION OF

AMSAT-B-L (36-5e)

3 OCT 1994

MEMORANDUM FOR Commander, U.S. Army Materiel Command,
ATTN: AMCIR-A, 5001 Eisenhower Avenue,
Alexandria, VA 22333-0001

SUBJECT: Command Comments to the Department of Defense Inspector General (DODIG) Draft Audit Report, Statistical Process Control at McDonnell Douglas Helicopter Systems, (Project 3CA-1050) (AMC No. D9317) (ATCOM Project No. 04-0293-427)

1. Reference memorandum, HQ USAMC, AMCIR-A, 8 Sep 94, SAB.

2. The enclosed comments represent the Aviation PEO and ATCOM position on the subject draft report.

3. Point of contact for this action is Mr. Charles I. Horn, DSN 693-3736 or Commercial (314) 263-3736.

Encl

JOHN S. COWINGS
Major General, USA
Commanding

Final Report Reference

COMMAND COMMENTS
DEPARTMENT OF DEFENSE INSPECTOR GENERAL DRAFT REPORT
STATISTICAL PROCESS CONTROL
AT MCDONNELL DOUGLAS HELICOPTER SYSTEMS
(ATCOM PROJECT NO. 04-0293-427)

Finding and Recommendation A--Negotiation and Implementation of Statistical Process Control System

McDonnell Douglas Helicopter did not fully implement a contractually required SPC system at its Mesa facility. The SPC system was not fully implemented because:

-Identifiable contractual funding and reporting requirements were not negotiated.

-The resident DPRO did not provide continuous oversight over the implementation of the SPC system.

-McDonnell Douglas Helicopter managers resisted SPC requirements implementation.

-As a result, DOD expended at least $4.4 million in SPC system funds on Apache helicopter contracts without fully gaining the benefits derived from the SPC system.

Additional Facts.

None.

Recommendation 1. That the Commander, Army Aviation and Troop Command, direct that the Army Aviation and Troop Command AH-64 Apache attack helicopter contracting officer negotiate and include in program year 12 modifications to contracts DAAJ09-89-C-A003 and any other subsequent negotiated statistical process control efforts with McDonnell Douglas Helicopter Systems:

Revised

a. A separate contract line item detailing funds appropriated for the implementation of the statistical process control system and

b. A contract data requirement line item required by the contract delineating specific statistical process control reporting requirements and submissions to implement and monitor the statistical process control system required by the contract.

Action Taken.

1. Nonconcur with Recommendation 1.a.

a. The requirement for statistical process control (SPC) was included in the production contract during the negotiations of Program Year 8 and 9 contracts in response to DOD efforts to improve quality through the use of such management tools. The intent was to:

-Require McDonnell Douglas Helicopter Systems (MDHS) to begin the process of instituting SPC within the company to include flow down to its' vendors.

-Ensure that MDHS had a plan for the implementation of SPC.

-Give MDHS the necessary autonomy to manage the process of instituting SPC and

-Limit the cost to the government.

The negotiated funding was based on the estimated additional effort that would be required during one 12-month period to develop a plan and begin implementing it. After one 12-month period any additional costs were to be born by MDHS. Because the funded effort was limited to a single 12-month period, it was not considered cost effective to mandate separate tracking of the funds, but to include them in Quality Engineering. As the government funded effort is complete, revising the contract at this time to mandate visibility of spending on SPC will have no beneficial effect.

b. Including SPC requirements as a separate contract line item with a separate price for implementation is not an appropriate contracting practice, because such a requirement is a management control function and, as such, is not a deliverable item to the Government. In addition, we believe that the inclusion of a SPC requirement as a separate line item would be in violation of the Secretary of Defense's (SECDEF) policy statement, dated 29 Jun 94, subject: Specification and Standards - A New Way of Doing Business. This policy stated that "Program Managers shall use management and manufacturing specifications and standards for guidance only." MDHS has incorporated SPC into its' quality control program as a management tool in controlling and monitoring performance. The statement of work (SOW) for Program Year 12 will require that MDHS continue to maintain a SPC effort to review manufacturing results as a management process for minimizing production problems.

2. Nonconcur with Recommendation 1.b. Requiring MDHS to produce an acceptable deliverable to report on the progress of implementing SPC was not considered cost effective when Program

Year 8 was negotiated. Since then, the government funded portion of SPC implementation has been completed under Program Year 8 & 9. There is no benefit to adding a contract data requirements list (CDRL) item to DAAJ09-89-C-0003 describing the reporting requirements on future activity. MDHS has incorporated SPC into its' quality program as one management tool in controlling quality. Mandating that MDHS separately report on SPC on any subsequent contract is not considered cost effective. However, the Statement of Work for Program Support Year 12, paragraph 3.7, does require MDHS to submit their policy, procedures and implementation methods to the Government for review and concurrence.

3

Defense Logistics Agency Comments

DEFENSE LOGISTICS AGENCY
HEADQUARTERS
CAMERON STATION
ALEXANDRIA, VIRGINIA 22304-6100

IN REPLY REFER TO DDAI

19 OCT 1994

MEMORANDUM FOR ASSISTANT INSPECTOR GENERAL FOR AUDITING
DEPARTMENT OF DEFENSE

SUBJECT: DoD IG Draft Report, Statistical Process Control at McDonnell Douglas Helicopter Systems (Project No. 3CA-5010.01)

This is in response to your request of 24 August 1994.

2 Enclosures

for JACQUELINE G. BRYANT
Chief, Internal Review Office

CF:

AQCBA
AQCOA

TYPE OF REPORT: Audit

PURPOSE OF INPUT: Initial Position

AUDIT TITLE & NUMBER: Statistical Process Control at McDonnell Douglas Helicopter Systems (Project No. 3CA-5010.01)

FINDING A: NEGOTIATION AND IMPLEMENTATION OF STATISTICAL PROCESS CONTROL SYSTEM: McDonnell Douglas Helicopter did not fully implement a contractually required SPC system at its Mesa facility. The system was not fully implemented because:

a. Identifiable contractual funding and reporting requirements were not negotiated.

b. The resident DPRO did not provide continuous oversight over the implementation of the SPC system.

c. MDHS managers resisted SPC requirements implementation.

As a result, DoD expended at least $4.4 million in SPC system funds on Apache helicopter contracts without fully gaining the benefits derived from the SPC system.

DLA COMMENTS:

a. CONCUR

The Aviation and Troop Command (ATCOM) contractual philosophy was to allow MDHS the flexibility to apply SPC where it was most beneficial. There were no reporting requirements delineated in the Statement of Work to provide SPC project status or to track costs associated with SPC activity.

b. PARTIALLY CONCUR

Past audits and investigations provide objective evidence that indicates there was DPRO oversight/surveillance on SPC activities. The DPRO agrees that major issues/changes to the Master Notebook and subject notebooks at DPRO Mesa should have been better documented. DPRO will establish a surveillance plan which includes a requirement for detailed documentation on MDHS management of SPC efforts.

c. PARTIALLY CONCUR

The methods for performing the surveillance of the contractor's SPC program are inadequately defined in the DPRO's Standard Operating Procedures. SPC data was being collected by the QAS's in the manufacturing area; however, the data was not used for analysis. The DPRO and MDHS personnel are inadequately trained in SPC techniques, such as Short Run SPC and SPC chart interpretation and analyses. Personnel training records examined

at both MDHS and the DPRO indicated that SPC training is being conducted. In addition, the record reflected a high percentage of completion and management participation in accordance with the SPC training plan. There are no weaknesses in the DPRO SPC Program Surveillance Operation that are not correctable; however, refresher SPC training in required.

Because the DPRO and MDHS were following the contract SOW and the customer's desires, the buying command has indicated its satisfaction with the benefits derived from SPC efforts on the AH-64 Apache helicopter.

DISPOSITION:
(X) Action is Ongoing. Estimated completion Date: 2nd Qtr FY95

INTERNAL MANAGEMENT CONTROL WEAKNESSES:
(X) Concur; however weakness is not considered material

ACTION OFFICER: LTC J.G. Hill, USA, AQCOA
PSE REVIEW/APPROVAL: Robert P. Scott, Exec Dir, Contract Mgmt
COORDINATION: Terry Eargle, CAPT, USN, Chief, AQCOA
Charles Bartlett, COL, USA, Ass't Exec Dir, AQCO
Eileen Sanchez, FOE
D. Stumpf, DDAI, 17 Oct 94
S Kanes for J Bryant 18 Oct 94

DLA APPROVAL:

18 OCT 1994

LAWRENCE P. FARRELL, JR.
Major General, USAF
Principal Deputy Director

Final Report Reference

TYPE OF REPORT: Audit

PURPOSE OF INPUT: Initial Position

AUDIT TITLE & NUMBER: Statistical Process Control at McDonnell Douglas Helicopter Systems
Project No. 3CA-5010.01)

RECOMMENDATION 2: Recommend that the Commander, Defense Contract Management Command:

a. Require that an operationally effective statistical process control system be fully implemented for the AH-64 Apache attack helicopter for program year 12 and that an equitable adjustment be determined for that portion of the statistical process control system that MDHS did not implement during program years 8 through 11.

Revised

b. Issue written internal control objectives and verification techniques to validate and support Government administration and justify the operational effectiveness of contractually-required statistical process control systems.

DLA COMMENTS:

a. PARTIALLY CONCUR

(1) Require that an operationally effective statistical process control system be fully implemented for the AH-64 Apache attack helicopter for program year 12. (CONCUR) MDHS has extensively implemented numerous SPC projects since the SPC implementation plan was presented to the government and accepted. However, the management system to control the SPC program has not been well documented by the contractor, nor formally verified and documented by the DPRO. The Aviation and Troop Command (ATCOM), in the Program System Support year 12, has elected to continue with the SOW requirements on SPC with only minor modification to the language in order to continue to provide the desired level of management flexibility. Individual SPC project changes, i.e., deletions of specific SPC projects and the rationale for changes were not well documented by the contractor. DCMC also concurs that the DPRO should intensify its efforts to ensure MDHS employs sound SPC management practices and establishes a well documented audit trail of individual SPC projects and major decision making milestones. The management plan should be maintained by the contractor in accordance with the approved April 1992 SPC implementation plan. The DPRO will intensify its monitoring of MDHS's SPC management practices to ensure the April 1992 implementation plan is followed.

(2) Requires that an equitable adjustment be determined for that portion of the statistical process control system that MDHS

Final Report Reference

Revised

did not implement during program years 8 through 11. (Nonconcur) Past and present ACOs concur that MDHS has met the requirement of the contract, therefore, no equitable adjustment is warranted.

b. PARTIALLY CONCUR

Although the current internal control objectives and verification techniques are written, and should be sufficient to cover SPC, DCMC does concur that they should be clarified to specifically delineate SPC requirements. DPRO has revised its management controls to specifically focus on MDHS's SPC implementation process, and ensure the approved April 1992 SPC implementation plan is followed.

DISPOSITION:
(x) Action is Considered Complete.

INTERNAL MANAGEMENT CONTROL WEAKNESSES:
(x) Concur; however weakness is not considered material

ACTION OFFICER: LTC J.G. Hill, USA, AQCOA
PSE REVIEW/APPROVAL: Robert P. Scott, Exec Dir, Contract Mgmt,
COORDINATION: Terry Eargle, CAPT, USN, Chief, AQCOA
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DLA APPROVAL:

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