

Audit



Report

OFFICE OF THE INSPECTOR GENERAL

**ACQUISITION OF THE F/A-18 RADAR
UPGRADE PROGRAM**

Report No. 95-070

December 30, 1994

This special version of the report has been revised to omit proprietary data.

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Acronyms

GAO	General Accounting Office
LRIP	Low-Rate Initial Production
NAVAIR	Naval Air Systems Command
NATO	North Atlantic Treaty Organization
RUG	Radar Upgrade



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



December 30, 1994

MEMORANDUM FOR ASSISTANT SECRETARY OF THE NAVY (FINANCIAL
MANAGEMENT)

SUBJECT: Acquisition of the F/A-18 Radar Upgrade Program (Report No.95-070)

We are providing this final report for your review and comments. This report addresses the adequacy of the acquisition management for the F/A-18 Radar Upgrade Program. Comments on a draft of this report were considered in preparing the final report.

DoD Directive 7650.3 requires that all recommendations be resolved promptly. Therefore, we request that the Commander, Naval Air Systems Command, and the F/A-18 Program Office provide comments on the finding, recommendations, and potential monetary benefits by February 28, 1995. DoD Directive 7650.3 also requires that comments indicate concurrence or nonconcurrence in each recommendation addressed to you. If you concur, describe the corrective actions taken or planned, the completion dates for actions already taken, and the estimated dates for completion of planned actions. If you nonconcur, state your specific reasons for each nonconcurrence. If appropriate, you may propose alternative methods for accomplishing desired improvements.

If you nonconcur with the estimated monetary benefits of \$57.1 million (Radar Upgrade breakout and use of the Automated Module Component Assembly machine) or any part, you must state the amount you nonconcur with and the basis for your nonconcurrence. Recommendations and potential monetary benefits are subject to resolution in accordance with DoD Directive 7650.3 in the event of nonconcurrence or failure to comment.

We appreciate the courtesies extended to the audit staff. If you have any questions on this audit, please contact Mr. John Meling, Program Manager, at (703) 604-9091 (DSN 664-9091) or Mr. David Wyte, Project Manager, at (703) 604-9027 (DSN 664-9027). Appendix G lists the distribution of the 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. 95-070
(Project No. 4AS-0010)

December 30, 1994

ACQUISITION OF THE F/A-18 RADAR UPGRADE PROGRAM

EXECUTIVE SUMMARY

Introduction. The F/A-18 Radar Upgrade (RUG) Program will provide the United States and its North Atlantic Treaty Organization partners with a new AN/APG-73 radar that has improved target identification and jamming capabilities for the F/A-18 aircraft. The F/A-18 RUG is a Navy program with estimated U.S. development and procurement costs of \$1.4 billion (then-year dollars) for approximately 270 RUG sets for new and existing F/A-18 C/D aircraft. An additional 204 AN/APG-73 RUGs will be acquired as part of the airframe production contract for F/A-18 E/F aircraft.

Objectives. The audit objective was to evaluate the overall acquisition management of the RUG for the F/A-18 aircraft. Specifically, we determined the adequacy of efforts to develop an economical and efficient radar system and to prepare the system for production and deployment. We also reviewed associated internal controls.

Audit Results. Overall, the Navy was effectively managing the RUG program. The F/A-18 Program Office had reduced program risks so that component breakout of the RUG is now viable. As a result, the Navy has the opportunity to reduce program costs during the Future Years Defense Program (FYs 1996 through 2001) and beyond by breaking out the RUG beginning in FY 1998.

Internal Controls. The internal controls applicable to the RUG program were deemed to be effective in that the audit did not identify any material internal control weaknesses. See Part I for internal controls assessed. We also reviewed the portion of the Internal Management Control Program applicable to the RUG program and found it to be effectively implemented.

Potential Benefits of Audit. The Navy could reduce costs by approximately \$57.1 million during the Future Years Defense Program by breaking out the RUG as Government-furnished equipment and Hughes using the Automated Module Component Assembly machine. Appendix E lists potential benefits of the audit.

Summary of Recommendations. We recommended that:

- o the F/A-18 Program Office implement a risk management program, reconsider its RUG breakout decision, and provide the RUG as Government-furnished equipment for production F/A-18 aircraft beginning in FY 1998 and

- o the Naval Air Systems Command provide the F/A-18 Program Office the staff needed to manage the RUG breakout program.

Management Comments. The Navy concurred in implementing a risk management program but nonconcurred in breaking out the RUG for production F/A-18 aircraft beginning in FY 1996 and staffing the F/A-18 Program Office to manage the RUG breakout program. The Navy stated that the following factors mitigated against breakout for F/A-18 production aircraft: stability of the hardware design, anticipated producibility and reliability enhancements, parts obsolescence, and need for a level III data package if the Navy decided to compete the radar procurement as part of a component breakout decision. Part II contains a detailed discussion of management comments to the report; and Part IV contains the complete text of management's comments.

Audit Response. In recognition of Navy concerns on stabilizing the RUG hardware design and acquiring a level III data package and plans to delay the RUG full-rate production decision to July 1996, we modified the report to recommend break out for the F/A-18 production aircraft beginning with the FY 1998 acquisition rather than the FY 1996 acquisition. As Hughes has demonstrated the ability to produce and deliver reliable and quality radars on-time, we still maintain that it makes good business sense to break out the radar for F/A-18 production aircraft beginning in FY 1998.

Accordingly, we request that the Assistant Secretary of the Navy (Research, Development and Acquisition) reconsider her position on the nonconcurrences and provide additional comments on the potential monetary benefits in response to the final report by February 28, 1995.

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This report was prepared by the Acquisition Management Directorate, Office of the Assistant Inspector General for Auditing, Department of Defense.

Part I - Introduction

Background

The F/A-18 aircraft serves the Navy fleet in multiple missions, including escort, air superiority, and air defense in the fighter aircraft configuration and interdiction, close air support, defense suppression, and strike in the attack aircraft configuration. The F/A-18 Radar Upgrade (RUG) Program is being developed to replace the AN/APG-65 radar for the United States and its North Atlantic Treaty Organization (NATO) partners. The new AN/APG-73 radar will provide improved radar sensitivity for target identification and improved resistance to radar jamming.

The F/A-18 Program Office manages the RUG acquisition for the Navy. In June 1989, the Navy Acquisition Executive decided to develop RUG prototypes and in June 1991 authorized the beginning of low-rate initial production (LRIP). In April 1990, McDonnell Douglas Aerospace (McDonnell Douglas) was awarded a fixed-price incentive fee contract, totaling \$223 million, for development of RUG prototypes and LRIP quantities. McDonnell Douglas subcontracted the RUG development and production to Hughes Aircraft Company (Hughes) and is responsible for integrating the RUG into new F/A-18s during assembly. The Navy plans to retrofit the RUG to existing F/A-18s by purchasing directly from Hughes while McDonnell Douglas will purchase the radar RUG sets from Hughes for F/A-18s in production.

In the FY 1995 President's budget, the Navy estimated that U.S. development and procurement costs will be \$1.4 billion (then-year dollars) for approximately 270 RUG sets for new and existing F/A-18 C/D aircraft (See Appendix A for a funding breakout). The Navy will acquire an additional 200 RUG sets as part of the airframe production contract for the F/A-18 E/F aircraft.

Objectives

The audit objective was to evaluate the overall management effectiveness of the RUG acquisition to determine whether the RUG was being cost-effectively developed and prepared for production and deployment. We followed our critical program management elements for the audit and tailored the audit objectives and scope to the RUG's engineering and manufacturing development phase. We reviewed requirements' evolution and affordability, acquisition planning and risk management, engineering and manufacturing, logistics and other infrastructure, test and evaluation, contract performance measurement, contracting, and internal controls related to these objectives.

At the completion of the survey, we determined that additional work was unnecessary for requirements' evolution and affordability, logistics and other infrastructure, test and evaluation, and contract performance measurement (Appendix B). During the survey, we also identified issues in engineering and manufacturing and in contracting, which are discussed in "Other Matters of Interest." Part II addresses the finding on RUG breakout pertaining to acquisition planning and risk management.

Scope and Methodology

This program results audit was performed from November 1993 through August 1994 in accordance with auditing standards issued by the Comptroller General of the United States and implemented by the Inspector General, DoD. The audit included tests of internal controls as necessary. We reviewed data for the F/A-18 RUG prototype development decision from June 1989 through August 1994 to accomplish our audit objectives. Data reviewed included acquisition strategies and plans, system operating requirements, contracts, risk assessments, acceptance test procedures, and a component breakout analysis. With assistance from personnel at Defense Plant Representative Offices and Defense Contract Audit Agency offices, we analyzed the RUG for component breakout potential. We also analyzed the risks identified in the Navy's Breakout Study, dated January 20, 1992, and the mitigation of those risks (Appendix C). We did not rely on computer-processed data to support the finding and recommendations in this audit report. Appendix F lists the organizations visited or contacted.

The Office of General Counsel, DoD, assisted in our review of a NATO cooperative funding agreement for the F/A-18 RUG Program.

Internal Controls

We assessed internal controls related to the critical program management elements of the RUG acquisition. We reviewed the F/A-18 Program Management Office's most recent vulnerability risk assessments and Internal Management Control Program review. The audit did not identify any material internal control weaknesses as defined in DoD Directive 5010.38, "Internal Management Control Program," April 14, 1987. Also, the Internal Management Control Program was effectively implemented.

Introduction

Prior Audits and Other Reviews

Since 1989, the F/A-18 RUG program has been the subject of three General Accounting Office (GAO) audits that related to our audit objectives.

On June 15, 1994, the GAO issued a draft report "Electronic Warfare: Testing of Navy Aircraft Radars Needed Before Production," (Office of the Secretary of Defense Case No. 9712). GAO recommended that the AN/APG-73 radars successfully complete operational testing before the units are produced for retrofit of older F/A-18 aircraft. DoD partially concurred, stating that retrofit of AN/APG-73 radars would be limited to 27 F/A-18 aircraft before completion of operational testing.

In September 1992, the GAO issued Report No. NSIAD-92-81 (Office of the Secretary of Defense Case No. 9248), "Embedded Computer Systems - New F/A-18 Capabilities Impact Navy's Software Development Process." While adding new F/A-18 capabilities, the GAO reported that the Navy must accommodate requirements and schedules of 28 other F/A-18 programs, accommodate changes to the F/A-18 software baseline, recognize the burden on F/A-18 software development, and initiate a process review. The Navy concurred with the GAO's recommendation, conducted an official software audit, and implemented software process improvements in time for use during the RUG operational flight program development.

In October 1990, the GAO issued Report No. NSIAD-91-27 (Office of the Secretary of Defense Case No. 8401), "NATO Cooperative Funding." The GAO stated that the Navy's internal controls were insufficient to ensure use of NATO cooperative research and development funds according to authorizing legislation. GAO recommended that DoD issue written instructions for implementing NATO cooperative research and development programs. It also recommended that the Navy establish internal controls to ensure the appropriate use of funds. The Navy implemented GAO's recommendations.

Other Matters of Interest

During the audit, we identified areas of concern in engineering and manufacturing and in contracting.

Engineering and Manufacturing. Initial Navy flight tests indicated that RUG reliability thresholds may not be achieved. The Navy's developmental tester concluded that with "aggressive corrective actions," required reliability performance parameters could be met before the planned FY 1995 full-rate

production decision. The Navy testers believed the RUG reliability threshold parameters could be attained by correcting the identified hardware and software anomalies. Although the Program Office is taking aggressive corrective actions as recommended by the developmental testers, the Navy's operational test and evaluation agency's dedicated operational test has been delayed and the full-rate production decision has been slipped from October 1995 to July 1996. Before July 1996, production-representative F/A-18 C/D aircraft with the RUG will have been tested with the latest operational flight program software. Also, maintenance test and support equipment and maintenance documentation will have been validated to support the recommendation for fleet introduction. Accordingly, we believe the required reliability parameters will be met when flight tests are concluded.

Contracting. Hughes purchased an Automated Module Component Assembly System machine with its own capital to improve the efficiency and the cost-effectiveness of manufacturing various radars, including the F/A-18 RUG. The machine was to be used in manufacturing integrated circuit boards for the F-14, F-15, F-18, F-22, AV-8, and B-2 programs. Hughes made the investment with the belief that its equipment capital costs would be recovered in 2.3 years through manufacturing efficiencies. Although the machine was delivered in 1992, Hughes has not used the machine or amortized the \$1.1 million capital cost against Government contracts. In reviewing Hughes' RUG cost proposal, we noted that Hughes did not mention the availability of the machine and the potential impact of its use on reducing RUG manufacturing costs. Based on our discussions, the Procurement Contracting Officer stated in response to the draft report that he negotiated a \$427,100 price reduction for current RUG procurements. This action will result in an additional \$706,600 savings in the Future Years Defense Program. The complete text of management comments is in Part IV.

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Part II - Finding and Recommendations

Component Breakout of the Radar Upgrade

In January 1992, the F/A-18 Program Office (the Program Office) rejected component breakout for the RUG because of technical risks and the lack of staff to manage breakout. Although the Program Office had not implemented a formal risk management program, it reduced risks and made component breakout viable for production F/A-18 aircraft. Because the Program Office had no formal risk management program, it did not realize that program technical risks were reduced. By not breaking out the RUG for F/A-18 production aircraft, the Navy may miss the opportunity to better use as much as \$56 million during the Future Years Defense Program (FYs 1996 through 2001) and another \$19 million in later years.

Background

Component Breakout. Breakout is the process whereby the Government purchases components directly from the manufacturer or supplier and furnishes the end-item to the prime contractor as Government-furnished equipment. The Government eliminates the prime contractor's overhead and profit on those components, and the Government saves money.

Risk Management Program. A risk management program is a structured risk assessment and analysis process with user participation to identify risks early in the program. The risk management program provides proactive, "look ahead" risk assessment and review. It includes methods to eliminate or reduce risks to acceptable levels.

DoD Policy. DoD Instruction 5000.2, "Defense Acquisition Management Policies and Procedures," part 5, section A, February 1991, as updated in February 1993, requires that component breakout be considered in every program and be done when significant cost savings are possible and the technical or schedule risks of furnishing Government items to the prime contractor are manageable. In addition, part 5, section B requires program offices to establish a risk management program and apply it to areas of risk identified in DoD Manual 4245.7-M, "Transition From Development to Production," September 1985.

DoD Manual 4245.7-M requires a risk management program expressed as a matrix of critical design, test, and production issues. Program managers are to use templates in the Manual to outline areas of program risk and to develop solutions that eliminate or reduce program risk to an acceptable level.

Component Breakout Review. The Naval Air Systems Command (NAVAIR) issued a F/A-18 RUG component breakout review in January 1992. NAVAIR concluded that "the single positive aspect (potential cost avoidance of \$158.6 million by breaking out components) . . . is so large that acceptance of a higher degree of risk than one might normally be comfortable with may be fully warranted." In the report, NAVAIR identified 11 risks that needed to be addressed before a final breakout decision was possible. However, the risks NAVAIR identified were not sustaining ones but obstacles that time would resolve as shown in Appendix C.

Based on NAVAIR's review, the Program Office decided to break out the RUG used to replace AN/APG-65 radars in existing F/A-18 aircraft but not to break out the RUG for F/A-18 production aircraft. The Program Office rejected breakout for F/A-18 production aircraft because of McDonnell Douglas' total system integration responsibilities, the nonavailability of highly specialized Government personnel to manage RUG breakout, and the technically advanced nature of the RUG hardware.

Elimination and Reduction of Identified Program Risks

Without formally designing and implementing a risk management program as required by DoD Manual 4245.7-M, the F/A-18 Program Office developed solutions that eliminated or reduced program risk identified in NAVAIR's component breakout review to an acceptable level. Program Office contracts with McDonnell Douglas have reduced system integration risks and the need for highly specialized Government personnel to manage breakout of the RUG. Similarly, the design of RUG hardware has stabilized and Hughes has reduced program risks by producing a reliable RUG and contractually warranting its hardware.

Contracts. The Program Office has awarded McDonnell Douglas contracts that make McDonnell Douglas responsible for total system integration responsibility even if the RUG was provided as Government-furnished equipment and that make it possible for the Government to acquire the RUG directly from Hughes.

Contract N00019-92-C-0006. The statement of work makes McDonnell Douglas fully responsible for integrating and interfacing Government-furnished equipment into the F/A-18. Specifically, McDonnell Douglas is responsible for making F/A-18 weapon systems work according to specifications and, when defects exist, identify fault causes and take corrective actions.

Contract N60530-92-C-0032. The statement of work for the F/A-18 flight program software contract makes McDonnell Douglas responsible for designing, merging, and integrating software changes. Therefore, McDonnell

Component Breakout of the Radar Upgrade

Douglas must ensure that the RUG software meets specifications no matter who furnishes the RUG hardware. Additionally, as system integrator for F/A-18 software, McDonnell Douglas must forge and maintain relationships with all vendors to fulfill its contract.

Contract N00019-89-C-0130. The Program Office acquired the RUG hardware specifications and level II drawings through this contract. This contract makes it possible for the Program Office to acquire the RUG directly from Hughes and to provide the RUG to McDonnell Douglas as Government-furnished equipment.

Managing the RUG Breakout. Highly specialized personnel are required to ensure that Hughes produces the RUG in accordance with specifications. Through the contracts listed above, the Program Office has reduced program risks associated with managing component breakout by making McDonnell Douglas responsible for ensuring that the RUG software meets specifications no matter who furnishes the RUG hardware. In Figures 1 and 2, we show how McDonnell Douglas' technical personnel remain involved with Hughes for identifying and resolving RUG hardware problems no matter who furnishes the RUG for the F/A-18.

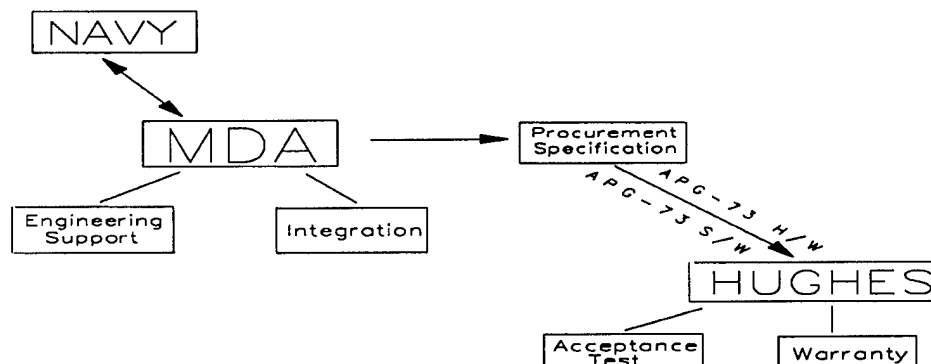


Figure 1. APG-73 Contractor-Furnished Procurement

Component Breakout of the Radar Upgrade

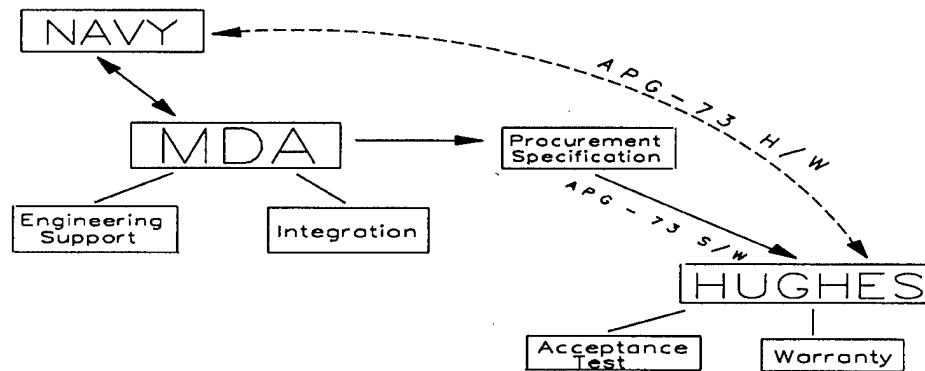


Figure 2. APG-73 Government-Furnished Procurement

H/W hardware
MDA McDonnell Douglas Aerospace
S/W software

Stability of the RUG Hardware. The RUG hardware design will stabilize before the full-rate production decision planned for July 1996. Further, Hughes has reduced program risks by demonstrating that it produces a reliable RUG and contractually warranting its hardware.

Hardware Design. The RUG hardware design has stabilized as a result of program changes. Through August 1994, McDonnell Douglas has ordered more than 80 Phase I RUGs. Initially, the Program Office planned a three-phased acquisition of the RUG. Because of funding constraints, it is now unlikely that additional changes will be made to the hardware design.

Phase I. In Phase I, Hughes replaced three of the five AN/APG-65 weapons replaceable assemblies. The hardware modification increased radar data storage and processing capabilities. Phase I is complete as McDonnell Douglas has demonstrated through testing that the AN/APG-73 radar performed equal to or better than the AN/APG-65 radar.

Phase II. In Phase II, Hughes will add an advanced air-to-ground mapping weapons replaceable assembly to the radar. The addition will enhance the F/A-18's reconnaissance and weapons missions. As of December 1994, Phase II testing was in the planning process. The Phase II RUG modification will not change the Phase I RUG hardware configuration.

Phase III. Phase III is an unfunded requirement. During Phase III, the Program Office planned to replace the RUG's transmitter and antenna weapons replaceable assemblies with an active scanned array antenna system. A definite date for Phase III implementation has not been established because projected development costs appear prohibitive.

Component Breakout of the Radar Upgrade

Reliability. McDonnell Douglas has recognized Hughes as a reliable and quality vendor and awarded it a "gold" rating for performance; Hughes' on-time delivery has been superior. As a result of experience with the AN/APG-65 radar, McDonnell Douglas does not observe Hughes' acceptance tests of the AN/APG-65 radar. On delivery, McDonnell Douglas directly installed the AN/APG-65 radar into production F/A-18 aircraft without pre-installation testing. Because of McDonnell Douglas' confidence in the quality of Hughes radars, McDonnell Douglas paid Hughes on delivery of AN/APG-65 radars rather than wait for complete F/A-18 weapons system installation and functional capability testing.

Hughes' Contract Warranty. Contractually, Hughes warranted that the quality of the AN/APG-73 radars conformed to procurement specifications and were free from defects on delivery to McDonnell Douglas. In addition, Hughes has an on-site repair capability to perform warranty work at the McDonnell Douglas F/A-18 assembly facility. The on-site repair capability allows McDonnell Douglas and Hughes personnel to expedite the correction of any defects identified.

Feasibility of Furnishing Government-Furnished Equipment

The F/A-18 Program Office demonstrated the feasibility to provide McDonnell Douglas with Government-furnished equipment on F/A-18 production aircraft contracts and still hold the contractor responsible for total system integration responsibility. Specific Government-furnished equipment on F/A-18 aircraft production contracts include engines, mission computers, electronic countermeasure radars, and ejection seats. Revisiting the breakout decision, which includes a manpower analysis, will demonstrate whether existing staff is adequate, whether staff could be shifted from waning acquisition programs, or whether new hires could be justified. Although Government oversight was necessary to facilitate systems integration, McDonnell Douglas has successfully coordinated and overseen vendors' work to ensure that the Government-furnished equipment was compatible with other F/A-18 weapons system assemblies.

Benefits From Component Breakout

The Navy could avoid about \$56 million over the Future Years Defense Program (FYs 1996 through 2001) by breaking out the RUG starting with FY 1998 production buys (Appendix D). Further, McDonnell Douglas' profit,

Component Breakout of the Radar Upgrade

which is * percent of the markup, will not transfer to other Government contracts. The Navy could avoid another \$19 million for the breakout of the RUG beyond the Future Years Defense Program. Also, Foreign Military Sales customers could avoid spending \$7 million for F/A-18 aircraft under contract and another \$50 million for planned F/A-18 aircraft procurements.

Conclusion

The Program Office's decision not to break out the RUG for future production F/A-18 aircraft was reasonable in January 1992 as the risk was deemed to be significant. Since January 1992, however, the Program Office has reduced program risks identified in the NAVAIR's component breakout review to the extent that component breakout of the RUG for F/A-18 aircraft in production is now viable.

Recommendations, Management Comments, and Audit Response

1. We recommend that the F/A-18 Program Office:

a. **Execute a risk management program in accordance with requirements in DoD Manual 4245.7-M, "Transition From Development to Production."**

Management Comments. The Assistant Secretary of the Navy (Research, Development and Acquisition) partially concurred, stating that implementation of a formal risk management program was an excellent idea to support the furnishing of the radar as Government-furnished equipment to retrofit existing F/A-18 aircraft beginning in FY 1998. The complete text is in Part IV.

Audit Response. In response to the final report, we request that the F/A-18 Program Office provide an estimated completion date for implementing the formal risk management program.

b. **Reconsider its Radar Upgrade breakout decision made in January 1992.**

Management Comments. The Assistant Secretary of the Navy (Research, Development and Acquisition) stated that the Navy still considered breakout of the RUG for F/A-18 production aircraft beginning in FY 1996 as too large a risk to aircraft deliveries. She cited factors that mitigated against an FY 1996 breakout for F/A-18 production aircraft: the hardware design has not

*Proprietary data removed.

Component Breakout of the Radar Upgrade

sufficiently stabilized, further producibility and reliability enhancements are anticipated, and parts obsolescence is a continuing concern. She also stated that the report recommendation did not recognize the time needed for the F/A-18 Program Office to acquire a level III data package necessary to award FY 1996 long-lead contracts if the Navy decided to compete the radar procurement as a part of a component breakout decision.

Audit Response. In recognition of Navy concerns on the stability of the RUG hardware design and acquiring a level III data package and on events since issuance of the draft report, we modified Recommendation 1.c. to recommend breakout for the F/A-18 production aircraft beginning with the FY 1998 acquisition rather than the FY 1996 acquisition. Since September 1994:

- o the F/A-18 Program Office has delayed the planned RUG-dedicated operational test and evaluation and requested that the RUG full-rate production decision be rescheduled from October 1995 to July 1996 because of software development problems and

- o the Navy has eliminated 36 F/A-18 production aircraft in FY 1997.

Before seeking a RUG full-rate production decision in July 1996, the Navy's operational test and evaluation agency will have to have determined that the RUG meets all operational requirements, is producible within acceptable cost and schedule risks, and is operationally supportable. As part of this determination, the agency will have to have concluded that the Hughes' radar hardware design has stabilized to warrant a decision to enter full-rate production for the RUG. Breaking out the radar for the FY 1998 RUG acquisition will also give the F/A-18 Program Office time to acquire a level III data package necessary to award FY 1998 long-lead contracts if the Navy decides to compete the radar procurement as part of a component breakout decision.

Producibility and reliability enhancements and parts obsolescence normally occur during the acquisition life cycle of all systems. Therefore, these factors do not preclude breaking out the radar.

Also, management's response is incongruent with the F/A-18 Program Office's plans to retrofit the RUG to existing F/A-18s beginning in FY 1998 by purchasing directly from Hughes. This action indicates that the Navy also is confident that Hughes can deliver RUGs that meet operational requirements, are producible within acceptable cost and schedule risks, and are operationally supportable.

Because Hughes has demonstrated to McDonnell Douglas that it is a reliable and quality vendor that can deliver radars on-time, we still believe that it makes good business sense to break out the radar for F/A-18 production aircraft beginning in FY 1998. Accordingly, we request that the Assistant Secretary of the Navy (Research, Development and Acquisition) reconsider her position to this recommendation in response to the final report.

Component Breakout of the Radar Upgrade

c. Break out the RUG for F/A-18 production aircraft beginning with the FY 1998 acquisition.

Management Comments. The Assistant Secretary of the Navy (Research, Development and Acquisition) nonconcurred and stated that the potential breakout savings of \$79 million over the Future Years Defense Program cited in the draft report was overstated by \$23.4 million. She stated that amounts budgeted in the FY 1995 President's Budget for the RUG were no longer valid. Specifically, RUG quantities planned for FY 1996 are 12 instead of 24 and for FY 1997 are 0 instead of 36.

Audit Response. We request that the Assistant Secretary of the Navy (Research, Development and Acquisition) reconsider her position to this recommendation in the final report based on our response to Recommendation 1.b. In the final report, we adjusted the potential break out savings to \$56 million based on management comments and beginning break out of the radar for F/A-18 production aircraft in FY 1998 rather than FY 1996.

2. We recommend that the Commander, Naval Air Systems Command, provide the F/A-18 Program Office the staff needed to manage Radar Upgrade breakout for F/A-18 production aircraft beginning with the FY 1998 acquisition.

Management Comments. The Assistant Secretary of the Navy (Research, Development and Acquisition) nonconcurred, stating that staff will not be needed based on management comments to Recommendations 1.b. and 1.c.

Audit Response. We request that the Assistant Secretary of the Navy (Research, Development and Acquisition) reconsider her position to this recommendation in the final report based on our response to Recommendations 1.b. and 1.c.

Note: We also made appropriate changes to the report based on specific management comments made on statements in the draft report. The complete text of management comments is in Part IV.

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Part III - Additional Information

Appendix A. F/A-18 Radar Upgrade Funding

FY 1995 President's Budget
(Then-year \$ in Millions)

	FYs												TOTAL
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	
Quantities:													
Production	0	0	15	36	36	24	24 ¹	24 ¹	48 ¹	67 ¹	0	0	274
Development	\$34.3	\$60.7	\$49.6	\$38.0	\$46.0	\$40.6	\$26.5	\$10.3	\$2.7	\$0.0	\$0.0	\$0.0	\$308.7
Production	0.0	0.0	230.2	155.6	133.0	76.3	90.0	82.3	148.9	166.3	0.0	0.0	1,082.6
Total	\$34.3	\$60.7	\$279.8	\$193.6	\$179.0	\$116.9	\$116.5	\$92.6	\$151.6	\$166.3	\$0.0	\$0.0	\$1,391.3

International Funding

	1988	1990	1991	1992	Non-Financial	Total
Nunn Funding ²	\$1,849,000	\$13,644,000	0	0	0	\$15,493,000
Canadian	0	31,500,000	6,580,000	400,000	3,920,000	\$42,400,000

¹ Excludes FY 1996 through FY 1999 RUG retrofits to be funded by AV-8 program.

² North Atlantic Treaty Organization Cooperative Research and Development

Appendix B. Areas Not Requiring Further Review

At the completion of the audit survey, we determined that additional audit work was not warranted for the following program management elements.

Requirements' Evolution and Affordability. The F/A-18 Program Office is adequately managing requirements' evolution and affordability. The user community has participated actively in defining requirements for the RUG development program. In addition, the Naval Center for Cost Analysis concluded that the Program Office's independent cost estimate for the RUG was reasonable.

Logistics and Other Infrastructure. The F/A-18 Program Office prepared logistics documents needed to support the RUG development program as required in DoD Instruction 5000.2. The documents included the Integrated Logistics Support Plan, Logistics Requirements and Funding Summary, and the Maintenance Plan. The NAVAIR Logistics Review Group assessed the adequacy of integrated logistics support for the third Phase I LRIP decision in November 1993. The Review Group recommended that the LRIP decision be withheld pending approval of a plan to resolve six findings developed during the review. In April 1994, the NAVAIR Logistics Department implemented a plan of corrective actions to address the six findings. The Program Office was acting on the plan of corrective actions.

Test and Evaluation. The Navy awarded F/A-18 production contracts before test results confirmed that the RUG was operationally effective and suitable. Since tests showed that the RUG was potentially operationally effective and suitable, the Navy decided it was cost-effective to install the RUG in production F/A-18 aircraft. Considering the Navy's alternatives, its decision was sound.

Contract Performance Measurement. McDonnell Douglas and Hughes had satisfactorily implemented contract performance measurement requirements. In addition, the contractors' estimated costs at completion were consistent with Defense Plant Representative Office and Defense Contract Audit Agency estimates.

Appendix C. Resolution of Breakout Analysis Risks

RESOLUTIONS OF IDENTIFIED RISKS

RISKS IDENTIFIED BY BREAKOUT STUDY	Design finalized RUGs delivered	Testing almost complete	RUGs acquired with F/A-18 contracts	600 flight tests made	Antennae not replaced	Hughes sole source vendor	Routine Support
Immature design	X						
Radar in development	X						
Prototypes untested	X	X	X	X			
Production not begun			X				
Needs flight tests			X	X			
Modification pending					X		
Needs phase approval			X				
Pending Navy support							X
FY96 parts support							X
Cannot be competed						X	
Proprietary parts						X	

Appendix D. Potential Breakout Savings

	FYs				
	(\$ in thousands)				
<u>Breakout Savings</u>	<u>FY 98</u>	<u>FY 99</u>	<u>FY 00</u>	<u>FY 01</u>	<u>Total</u>
RUG Assemblies ¹	24	36	36	48	
Savings per RUG ²	\$ 390	\$ 390	\$ 390	\$ 390	
Subtotal	\$ 9,360	\$14,040	\$14,040	\$18,720	
Reduced Contractor Staff	864	864	864	864	
Gross Savings	\$ 10,224	\$14,904	\$14,904	\$19,584	
Government Management Cost	-1,350	-1,000	-800	-800	
Net Savings ³	\$ 8,874	\$13,904	\$14,104	\$18,784	\$55,666

¹Future Years Defense Program planned production of F/A-18 aircraft as of March 1994.

²Contractor-Furnished Equipment, McDonnell Douglas' price per RUG \$*
Government-Furnished Equipment, Hughes' price per RUG \$*

Savings per RUG \$ 390,000

Represents * percent markup by McDonnell Douglas on Hughes' cost.

(Overhead at * percent, Cost of Money at * percent, and Profit at * percent)

³ Additional component breakout savings:

\$ 18,784,000 for 48 assemblies in the Navy's out years.

7,020,000 for 18 assemblies of Foreign Military Sales production under contract, and
49,980,000 for 128 assemblies of future Foreign Military Sales production.

* Proprietary data removed.

Appendix E. Summary of Potential Benefits Resulting From Audit

Recommendation Reference	Description of Benefit	Amount and/or Type of Benefit
1.a.	Compliance with Regulation. Will ensure the F/A-18 Program Office formalizes a risk management program.	Nonmonetary.
1.b.	Compliance with Regulation and Economy and Efficiency. Will ensure the F/A-18 Program Office revisits its breakout decision.	Nonmonetary.
1.c.	Compliance with Regulation and Economy and Efficiency. Will ensure the F/A-18 Program Office breaks out the RUG for FY 1998 full-rate production buys.	Funds Put to Better Use. Navy could save as much as \$56 million over the Future Years Defense Program. (FYs 1998 through 2001 Aircraft Procurement, Navy.)
2.	Compliance with Regulation. Will ensure that the AN/APG-73 Radar Upgrade breakout is managed as required.	Nonmonetary.

Appendix E. Summary of Potential Benefits Resulting From Audit

Reference	Description of Benefit	Amount and/or Type of Benefit
page 5.	Economy and Efficiency. Will ensure that the F/A-18 Program Office benefits from production efficiencies.	Funds put to better use. The Navy negotiated a \$427,100 savings for FYs 1994 and 1995 and could save another \$706,600 over the Future Years Defense Program. (FYs 1996 through 2001 Aircraft Procurement, Navy.)

Appendix F. Organizations Visited or Contacted

Office of the Secretary of Defense

Under Secretary of Defense for Acquisition and Technology, Washington, DC
International Cooperative Research and Development Programs, Washington, DC
Under Secretary of Defense (Comptroller), Washington, DC

Department of the Navy

Assistant Secretary of the Navy (Financial Management), Washington, DC
Assistant Secretary of the Navy (Research, Development and Acquisition),
Washington, DC
Navy International Program Office, Washington, DC
Director, Navy Test and Evaluation and Technology Requirements, Washington, DC
Naval Air Systems Command, Washington, DC
Program Executive Office, Tactical Aircraft Programs, Washington, DC
Program Executive Office, AV-8B Harrier Program Office, Washington, DC
Naval Air Warfare Center, Aircraft Division, Patuxent River, MD
Naval Air Warfare Center, Weapons Division, China Lake, CA
Naval Supply Systems Command, Norfolk, VA
Space and Naval Warfare Systems Command, Washington, DC
Navy Center for Cost Analysis, Washington, DC
Commander, Operational Test and Evaluation Force, Norfolk, VA

Department of the Air Force

Program Executive Office, Tactical and Airlift Programs, Washington, DC

Other Defense Organizations

Defense Logistics Agency, Headquarters, Alexandria, VA
Defense Contract Management Area Operations-Santa Ana, Santa Ana, CA
Defense Plant Representative Office-Hughes Aircraft Company, El Segundo, CA
Defense Plant Representative Office-McDonnell Douglas Aerospace, St. Louis, MO
Defense Contract Audit Agency, Headquarters, Alexandria, VA

Appendix F. Organizations Visited or Contacted

Other Defense Organizations (cont'd)

Defense Contract Audit Agency-Hughes Aircraft Company, El Segundo, CA
Defense Contract Audit Agency-McDonnell Douglas Aerospace, St. Louis, MO

Other Government Organization

U.S. General Accounting Office, Washington, DC

Contractors

Hughes Aircraft Company, El Segundo, CA
McDonnell Douglas Aerospace, St. Louis, MO

Appendix G. Report Distribution

Office of the Secretary of Defense

Under Secretary of Defense for Acquisition and Technology
Under Secretary of Defense (Comptroller)
Deputy Under Secretary of Defense (Acquisition Reform)
Assistant to the Secretary of Defense (Public Affairs)

Department of the Navy

Secretary of the Navy
Assistant Secretary of the Navy (Financial Management)
Assistant Secretary of the Navy (Research, Development and Acquisition)
Auditor General, Department of the Navy

Defense Organizations

Director, Defense Contract Audit Agency
Director, Defense Logistics Agency
Director, 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
U.S. General Accounting Office, National Security and International Affairs
Division, Technical Information Center

Chairman and Ranking Minority Member 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

Assistant Secretary of the Navy Comments



THE ASSISTANT SECRETARY OF THE NAVY
(Research, Development and Acquisition)
WASHINGTON, D.C. 20350-1000

DEC 7 1994

MEMORANDUM FOR THE DEPARTMENT OF DEFENSE ASSISTANT INSPECTOR
GENERAL FOR AUDITING

Subj: DODIG DRAFT REPORT ON ACQUISITION OF THE F/A-18 RADAR
UPGRADE PROGRAM (PROJECT NO. 4AS-0010)

Ref: (a) DODIG memo of 29 Sep 94

Encl: (1) Department of the Navy Response

I am responding to the draft audit report forwarded by
reference (a) concerning Acquisition of the F/A-18 Radar Upgrade
Program.

The Navy partially concurs with the finding and
recommendations. The Navy does not believe that breakout of
Radar Upgrade components is appropriate for FY-96 forward fits
due to hardware instability. However, the cost benefit of
breakout for the later retrofit program is under review. Also,
we do not concur with the potential breakout savings of \$79
million. These savings are overstated by \$23.4 million.

Our detailed response to the audit is provided as
enclosure (1).

Copy to:
NAVINGEN
NCB-53
COMNAVAIRSYSCOM (AIR-8.0G)

DEPARTMENT OF THE NAVY RESPONSE

TO

DODIG DRAFT REPORT OF 29 SEPTEMBER 1994
ON
ACQUISITION OF THE F/A-18 RADAR UPGRADE PROGRAM
(PROJECT NO. 4AS-0010)

Finding A: Component Breakout of the Radar Upgrade

In January 1992, the F/A-18 Program Office (the program Office) rejected component breakout of the RUG because of technical risks and the lack of staff to manage breakout. Although the Program Office had not implemented a formal risk management program, it reduced risks and made component breakout viable for production F/A-18 aircraft. Because the Program office had no formal risk management program, it did not realize that program technical risks were reduced. By not breaking out the RUG for F/A-18 production aircraft, the Navy may miss the opportunity to better use as much as \$79 million during the Future Years Defense Program (FYs 1996 through 2001) and another \$19 million in later years.

Recommendations A-1:

We recommend that the F/A-18 Program Office:

- a. Execute a risk management program in accordance with requirements in DOD Manual 4245.7-M, "Transition From Development to Production."
- b. Reconsider its RUG breakout decision made in January 1992.
- c. Break out the RUG F/A-18 production aircraft beginning with the FY 1996 acquisition.

DON Position:

Partially concur. Implementation of the more formal DoD 4245.7-M risk management program suggested by the DODIG is an excellent idea for the GFE retrofit hardware procurements, anticipated to begin in FY-98. At that time, the government would assume total responsibility for managing the procurement vice the prime contractor. However, breakout of the RUG as GFE for forward fit production starting with FY-96 creates a larger risk to aircraft deliveries. This risk is currently borne by the contractor, who is contractually obligated to provide his own risk management program. Other factors which militate against an FY-96 breakout for forward fit is that the hardware has not yet sufficiently stabilized, further producibility and reliability enhancements are anticipated, and parts obsolescence is a continuing concern.

DON COMMENTS ON DODIG DRAFT AUDIT REPORT NO. 4AS-0010 "AUDIT OF THE ACQUISITION OF THE F/A-18 RADAR UPGRADE PROGRAM," SEPTEMBER 29, 1994

DON Position (cont):

Further, a change in procurement strategy, especially if competitive, could require procuring a Level III data package, which would not be available in time for FY-96 Long Lead contract authorization (anticipated March 95). The DODIG report has not addressed the lead time required to change the acquisition strategy and plan, the possibility that a breakout procurement would have to be competitive, and the impact of a competitive procurement on the program. The potential breakout savings calculated by DODIG are overstated. The RUG assemblies shown in Appendix D are based on the FY 1995 President's Budget which is no longer valid. The quantities planned for FY-96 are 12 instead of 24, and FY-97 are 0 instead of 36. As a result, the savings the DODIG computed are overstated by \$23.4 Million.

Recommendation A-2:

We recommend that the Commander, Naval Air Systems Command, provide the F/A-18 Program Office the staff needed to manage RUG breakout for F/A-18 production aircraft beginning with FY 1996 acquisition.

DON Position:

Do not concur. For reasons discussed above, we do not agree with the strategy to breakout the APG-73 radar starting with FY-96 production; and therefore, do not agree with the necessity to staff up the program office to accommodate a breakout program at this time.

The Following are Specific Comments and Corrections to the report text:

Page i. Audit Results: "...our audit showed that the F/A-18 Program Office had reduced program risks so that component breakout of the RUG is now viable."

Do not concur. The Program Office is assessing the cost benefit of breaking out retrofit components to the Original Equipment Manufacturer after the system design has stabilized. However, experience has shown that the best value to the Government comes by acquiring critical avionics systems and software through the F/A-18 systems integration prime, McDonnell Douglas. Additionally, the Government would have to manage the obsolescence issues now handled by the prime contractor, which we are not staffed to accomplish.

DON COMMENTS ON DODIG DRAFT AUDIT REPORT NO. 4AS-0010 "AUDIT OF THE ACQUISITION OF THE F/A-18 RADAR UPGRADE PROGRAM," SEPTEMBER 29, 1994

Page 2, Background: "In June 1989, the Navy Acquisition executive decided to develop RUG prototypes and begin low-rate initial production (LRIP)."

Do not concur. The June 1989 decision was to start development of the RUG program. Included in the decision memorandum from the meeting was the following: "An early Milestone IIIA NPDM will be held, prior to committing long lead funding for FY-92 aircraft production, to decide whether to go ahead with low rate initial production of the new radar." The June 1991 NPDM, Milestone IIIA, gave authority for FY-92 LRIP of 22 radars and long lead funding for 48 FY-93 radars.

Page 4, Prior Audits and Other Reviews: "The Navy concurred with the GAO's recommendation to initiate a process review to resolve high-priority problems before releasing new software to the fleet."

Concur. However, further clarification: An official software audit was accomplished and software process improvements implemented in time for use during Operational Flight Program 91C development.

Page 5, Contracting: "Based on our discussions, the Procurement Contracting Officer incorporated a clause in the F/A-18 contracts to recoup cost savings if Hughes does use the machine."

Partially concur. The Contracting Officer calculated and incorporated a per unit savings impact for FY-94 using the total dollar savings provided by the DODIG. No recoupment clause was incorporated. Given that the entire DODIG savings were received during negotiations, no recoupment clause was incorporated.

Page 9, Elimination and Reduction of Identified Program Risks: "...the design of RUG hardware was stabilized and Hughes has reduced program risks by producing a reliable RUG and contractually warranting its hardware."

Partially concur. The design of RUG has not completely stabilized. Additionally, there are several producibility and reliability improvements the Navy may consider that have come out of the Reliability Growth Tests completed in FY-94. Obsolescence of parts also causes continuing design iterations.

DON COMMENTS ON DODIG DRAFT AUDIT REPORT NO. 4AS-0010 "AUDIT OF THE ACQUISITION OF THE F/A-18 RADAR UPGRADE PROGRAM," SEPTEMBER 29, 1994

Page 11, Stability of the RUG Hardware: "The RUG hardware design has stabilized."

Partially concur. The design of RUG will soon reach stabilization. Additionally, there are several producibility and reliability improvements the Navy may consider that have come out of the Reliability Growth Tests completed in FY-94. Obsolescence of parts also causes continuing design iterations.

Page 11, Stability of the RUG Hardware, Phase II: "In phase II, Hughes is adding an advanced air-to-ground mapping weapons replaceable assembly to the radar...Phase II testing was still in-process."

Partially concur. Phase II development has not yet begun. Once given authority to start Phase II, Hughes will be adding air-to-ground mapping; testing has not yet begun.

Page 12, Reliability: "As a result of experience with the AN/APG-65 radar, McDonnell Douglas does not observe Hughes' acceptance tests of the APG-65 radar. On delivery, McDonnell Douglas directly installed the AN/APG-65 radar into production F/A-18 aircraft without pre-installation testing. Because of McDonnell Douglas' confidence in the quality of Hughes radars, McDonnell Douglas paid Hughes on delivery of AN-APG-65 radars rather than wait for complete F/A-18 weapons system installation and functional capability testing."

Concur. However, McDonnell does some pre-installation testing of the APG-73 receiver and has in-plant representatives to watch the APG-73 testing at Hughes. APG-73s are not at the maturity level of the APG-65s. Confidence in the APG-65 may not feed through to the APG-73 until the design has stabilized. Physical Configuration Audit has been completed and production processes have stabilized. APG-65s have been in full rate production for many years; the APG-73 is not expected to reach full rate production until 1997.

Page 13, Benefits from Component Breakout: "The Navy could avoid about \$79 million over the Future Years Defense Program...by breaking out the RUG starting with FY-96 production buys."

Do not concur. Potential savings are overstated for several reasons. First, the Navy does not plan to buy as many aircraft as the DODIG expected. The RUG assemblies shown in Appendix D of the DODIG report are based on the FY 1995 President's Budget which is no longer valid. The quantities planned for FY-96 are 12 instead of 24, and FY-97 are 0 instead of 36. As a result, the savings the DODIG computed are overstated by \$23.4 million.

DON COMMENTS ON DODIG DRAFT AUDIT REPORT NO. 4AS-0010 "AUDIT OF THE ACQUISITION OF THE F/A-18 RADAR UPGRADE PROGRAM," SEPTEMBER 29, 1994

Page 9, Contract N00019-92-C-0006: "The statement of work makes McDonnell Douglas fully responsible for integrating and interfacing Government-furnished equipment into the F/A-18."

Concur. However, the Government is responsible for any defective GFE.

Page 9, Contracts: "The Navy has three contracts with McDonnell Douglas."

This statement should read, "The Navy has four F/A-18 airframe contracts with McDonnell Douglas that are delivering AN/APG-73 units as contractor-furnished equipment:

FY-92 N00019-90-C-0285
FY-93 N00019-92-C-0006
FY-94 N00019-93-C-0033
FY-95 N00019-94-C-0084

FY-94 and FY-95 are long-lead authorizations.

Page 10, Contract N00019-89-C-0130: "The Program Office acquired the RUG hardware specifications and drawings through this contract."

Concur. However, the Program Office acquired Level II drawings through the contract. These would be usable for breakout to the Original Equipment Manufacturer, but not for a competitive contract. Were a competitive contract used, we would have to procure a Level III data package first, which may prove very expensive.

Page 10, Managing the RUG Breakout: "...the Program Office has reduced program risks associated with managing component breakout by making McDonnell Douglas responsible for ensuring that the RUG software meets specifications no matter who furnishes the RUG hardware."

Partially concur. As was stated earlier, the hardware has not yet sufficiently stabilized, further producibility and reliability enhancements are anticipated, and parts obsolescence is a continuing concern. The Navy is not ready for component breakout at this point in the RUG development.

DON COMMENTS ON DODIG DRAFT AUDIT REPORT NO. 4AS-0010 "AUDIT OF THE ACQUISITION OF THE F/A-18 RADAR UPGRADE PROGRAM," SEPTEMBER 29, 1994

Also, the DODIG has not considered the risk associated with managing and delivering GFE for the FY-96 procurement, which could result in production schedule delay and requests for equitable adjustments/ claims from the contractor.

The DODIG has not addressed the cost associated with buying a Level III data package, complete with extensive contracting time required to obtain proprietary data rights. This could substantially reduce the potential savings identified by the DODIG and the cost savings already incurred by the program from not having to buy proprietary rights.

Further, DFARS policy on component breakout stipulates that "DOD policy is to breakout components of weapons systems or other major end items...if...breakout action will not jeopardize the quality, reliability, performance, or timely delivery of the end item." We do not feel the program is mature enough nor is the manpower in place to breakout the RUG radar starting with FY-96 procurement (by March 1995) without jeopardizing timely delivery and, possibly, reliability.

Lastly, solutions to problems that may arise from parts obsolescence and ECCM software end item deliverables can often be fixed by either hardware or software. Leaving the contractor responsible for both ensures that the contractor has the freedom to approach the problem for the best long-term solution. Again, the CFE approach will present a more timely and integrated delivery of hardware and software end items.

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INTERNET DOCUMENT INFORMATION FORM

A . Report Title Acquisition of the F/A-18 Radar Upgrade Program

B. DATE Report Downloaded From the Internet: 03/01/99

C. Report's Point of Contact: (Name, Organization, Address, Office Symbol, & Ph #): OAIG-AUD (ATTN: AFTS Audit Suggestions)
Inspector General, Department of Defense
400 Army Navy Drive (Room 801)
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D. Currently Applicable Classification Level: Unclassified

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F. The foregoing information was compiled and provided by:
DTIC-OCA, Initials: __VM__ **Preparation Date** 03/01/99

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