

# Naval Audit Service



## Interim Audit Report



# Consideration of Hazardous Noise in the Acquisition of the Joint Strike Fighter

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N2009-0013

15 December 2008

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MEMORANDUM FOR ASSISTANT SECRETARY OF THE NAVY (RESEARCH,  
DEVELOPMENT AND ACQUISITION)  
PROGRAM EXECUTIVE OFFICER, JOINT STRIKE  
FIGHTER PROGRAM OFFICE

Subj: **CONSIDERATION OF HAZARDOUS NOISE IN THE ACQUISITION OF  
THE JOINT STRIKE FIGHTER (INTERIM AUDIT REPORT N2009-0013)**

Ref: (a) NAVAUDSVC Memorandum 7510 N2007-NIA000-0066, dated 10 Aug 07  
(b) SECNAVINST 7510.7F, "Department of the Navy Internal Audit"

Encl. (1) Status of Recommendations  
(2) Scope and Methodology  
(3) Pertinent Guidance  
(4) Safe Noise Exposure Duration Limits  
(5) Center for Naval Analyses Veterans Hearing Loss Disability Costs  
(6) Hearing Protection Suite  
(7) Original Management Response from Program Executive Officer, Joint Strike  
Fighter  
(8) NAVAUDSVC Rebuttals to Original Management Response from Program  
Executive Officer, Joint Strike Fighter  
(9) Revised Management Response from Program Executive Officer, Joint Strike  
Fighter

1. **Introduction.** In accordance with reference (b), we initiated the audit announced by reference (a) as it relates to multiple selected acquisition programs. Section 5 of this report provides our finding and recommendations, summarized management responses, and our comments on the responses. Enclosure 1 provides the status of the recommendations. The full text of original management responses is included in Enclosure 7, and the revised management response is in Enclosure 9. Summaries of the management responses, with our comments on the responses, are in paragraph 6. The Program Executive Officer for the Joint Strike Fighter (JSF) responded to the recommendations, and concurred with Recommendations 2 and 5, partially concurred with Recommendations 1 and 4, and nonconcurred with Recommendation 3. Actions planned by Program Executive Officer for the JSF meet the intent of Recommendations 2

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and 5. These recommendations are considered open pending completion of the planned corrective actions, and are subject to monitoring in accordance with reference (b). Management should provide a written status report on the recommendations within 30 days after the target completion dates. Responses to Recommendations 1, 3, and 4 did not meet the intent of the recommendations; therefore, they are being elevated to the Assistant Secretary of the Navy for Research, Development, and Acquisition (ASN (RDA)) for action. ASN (RDA) should provide comments on the undecided recommendations within 30 days; management may comment on other aspects of the report, if desired. Please provide all correspondence to the Assistant Auditor General for Installations and Environment Audits, [REDACTED] by e-mail at [REDACTED] with a copy to the Director, Policy and Oversight, [REDACTED], by e-mail at [REDACTED]. Please submit correspondence in electronic format (Microsoft Word or Adobe Acrobat file) and ensure that it is on letterhead and includes a scanned signature.

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a. This interim report addresses the results of our audit for the JSF. A senior DON official requested that the Naval Audit Service: (1) verify the existence, and assess the validity, of a noise waiver for the JSF aircraft, and (2) verify that safety and occupational health issues were addressed during the acquisition process of the JSF aircraft through efforts to mitigate the identified maintainer noise hazard. We found no evidence that a noise waiver for the JSF was ever required or granted. We also determined that there were opportunities for program management process improvements as they related to mitigating the maintainer noise hazard. Details of our JSF audit results are presented in Paragraph 5 “Summary of Audit Results and Conclusions.”

2. **Reason for Audit.** Our objectives<sup>1</sup> were to: (1) verify the existence, and assess the validity, of a noise waiver for the JSF aircraft, and (2) verify that safety and occupational health issues were addressed during the acquisition process of the JSF aircraft through efforts to mitigate the identified maintainer noise hazard.

### 3. **Background**

a. **Consideration of Safety and Occupational Health Issues.** The Department of Defense (DoD), Military Standard 882D, “Standard Practice for System Safety,” dated 10 February 2000, directed the integration of environmental, safety, and health hazard management into the systems engineering process for acquisition programs. According to the Standard, management of mishap risk associated with actual environmental and

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<sup>1</sup> The original objectives were to (1) verify the existence and assess the validity of a noise waiver for the Joint Strike Fighter (JSF) aircraft and (2) verify that safety and occupational health issues are addressed during the acquisition process of the JSF aircraft. The objectives were changed to specify the issue (maintainer noise hazard) that was assessed.

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health hazards is directly addressed by the system safety approach. The Standard defines system safety as the application of engineering and management principles, criteria, and

b. techniques to achieve acceptable mishap risk within the constraints of operational effectiveness and suitability, time, and cost, through all phases of the system life cycle. The objective of system safety is to achieve acceptable mishap risk through a systematic approach of hazard analysis, risk assessment, and risk management.

c. **Global War on Noise.** On June 8, 2007, the Deputy Assistant Secretary of the Navy for Safety (DASN(S)) issued a memo outlining a new initiative to bring attention to the increasing combat noise-induced hearing loss problem throughout DON, known as the Global War on Noise. DASN(S) expressed that “we continue to design and procure weapon systems that expose our personnel to levels of noise that even with the most advanced personal noise attenuation devices available, far exceed maximum allowable Occupational Safety and Health Administration (OSHA) standards. We can and must do a better job of protecting those men and women who routinely sacrifice so much for this country.” He further states that “it is obvious that, if we are to resolve our escalating hearing loss problem, increased emphasis must be placed in the design and acquisition of quieter equipment and the use of more effective engineering controls to reduce ambient noise levels.”

d. **Noise Hazard to Flight Deck Personnel.** Noise is defined in the JSF Programmatic Environment, Safety, and Occupational Health Evaluation (PESHE), dated March 2007, as unwanted sound that interferes with normal human activities or otherwise diminishes the quality of the environment. Hazardous noise exposure occurs in areas where noise levels exceed 84 decibels (dBs). Safe noise exposure duration limits are demonstrated in Enclosure 4. For military operations, aircraft noise that affects pilots and flight deck personnel is known as near-field noise. According to a Naval Air Warfare Center Technical Report, dated 18 May 2006, legacy military aircraft, such as the F/A-18, produce about 130-150 dBs of near-field noise. The report stated that aircraft carrier flight deck personnel work in close proximity to high-level aircraft engine noise for extended periods of time. It further reported that a typical busy day for flight deck personnel is approximately 60 aircraft launches and recoveries, and that flight deck personnel are exposed to 20-30 seconds of maximum power aircraft noise during each aircraft launch, and 3 seconds during recovery. According to the Naval Safety Center, continuous exposure to these hazardous noise levels reportedly leads to hearing loss among sailors. Furthermore, the Center for Naval Analyses reported that from 1996 to 2005 total Navy and Marine Corps veterans disability costs associated with hearing loss have steadily increased. The cost in 2005 was approximately \$200.7 million (see Enclosure 5).

e. **JSF.** The JSF Program is a DoD joint, multinational program that includes the Air Force, Navy, Marine Corps, and eight international partners as participants. According to the JSF Program Office (JPO), the JSF is a single-engine, single-seat, highly integrated

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air system that is designed to replace aging fighter inventories for the Air Force, Navy, and Marine Corps. There are three variants of the JSF: a conventional takeoff and landing (CTOL) variant for the Air Force, an aircraft carrier version (CV) for the Navy, and a short takeoff/vertical landing (STOVL) version for the Marine Corps. According to a Naval Air Warfare Center Technical Report, dated 18 May 2006, the JSF aircraft engine is predicted to produce 148-152 dBs of near-field noise depending on the power setting. In interviews with us, JPO representatives further defined near-field noise as maintainer noise (noise exposure to flight deck operators) and cockpit noise (noise exposure to pilots). At the time of this report, the JSF Program was in the System Development and Demonstration (SDD) phase of the acquisition cycle. The SDD phase began when the contract was awarded in October 2001 and includes the development and testing of the entire aircraft system. According to DoD Instruction 5000.2, SDD has two major efforts: System Integration and System Demonstration. System Integration is intended to integrate subsystems, complete detailed design, and reduce system-level risk. System Demonstration is intended to demonstrate the ability of the system to operate in a useful way consistent with the approved Key Performance Parameters (KPP). The next phase of the cycle is Production and Deployment.

f. **Meetings.** We briefed our audit results to JPO management on 20 February 2008 and 7 April 2008. In addition, we briefed our audit results to the following customers/stakeholders:

- Deputy Assistant Secretary of the Navy (DASN) for Research, Development and Acquisition (RDA) for Air Programs representatives - 19 March 2008;
- DASN for Safety (DASN(S)) - 8 May 2008;
- Director Air Warfare (N88) representatives - 25 March 2008;
- Fleet representatives from Fleet Forces Command, U.S. Pacific Fleet, Naval Air Forces Safety, and Commander, Naval Air Forces - 9 April 2008;
- Naval Safety Center representatives - 9 April 2008.

We provided a discussion draft to JPO representatives on 29 May 2008 and 15 July 2008 and met to discuss the discussion draft report on 5 June 2008 and 23 July 2008. There were no significant problems that needed to be addressed during the audit.

4. **Noteworthy Accomplishment.** The JSF Program sponsored the development of new technology hearing protection (see Enclosure 6). Rather than utilizing the existing hearing protection that provides 30 dB noise attenuation (noise level reduction) to the flight deck operators, the JSF Program recognized the need for more advanced hearing protection. Through Small Business Innovative Research (SBIR) projects, a suite of hearing protection technologies was developed. At the time of our review, test results supported that this hearing protection provided at least 43 dB noise attenuation with a reported goal of achieving up to 50 dB attenuation. While the new technology will not

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reduce hazardous noise exposure below the hazardous level of 85 dBs, it will lessen the degree of exposure to hazardous noise on the flight deck. The Naval Air Systems Command (NAVAIR) Improved Personnel Hearing Protection Team, which developed the new technology, will receive the Naval Air Warfare Center Aircraft Division (NAWCAD) Commander's Award on 16 December 2008 in recognition of their accomplishments.

## **5. Summary of Audit Results and Conclusions**

a. According to the JPO, the JSF aircraft could emit 152 dBs, which is well above the noise level considered hazardous to hearing (greater than 84 dBs). After attempting to verify the existence of a formal noise waiver, we found one had not been granted to the contractor, and one was not required. According to JPO representatives, it was known to industry that it may be unrealistic to reduce noise emitted from the aircraft engine to 84 dBs. While we agree, every effort should have been made to first minimize the noise level of the aircraft itself and then use other mitigation techniques, such as hearing protection devices, to protect the hearing of personnel exposed to hazardous noise. Conversely, there was no noise standard referenced in the Operational Requirements Document (ORD), other than a statement that noise should be minimized, or the contract, and there was no evidence that the JPO first attempted to mitigate the maintainer noise hazard early in the program acquisition through design selection. This is contrary to the system safety design order of precedence specified in the Military Standard 882D. Tests indicate that new technology hearing protection devices to enter the supply system will reduce maintainer noise; however, according to JPO representatives, personnel occupying three positions on the flight deck will still be exposed to a level that exceeds safe noise exposure duration limits. We also found that the JPO:

- Inappropriately reduced the Risk Assessment Code (RAC)<sup>2</sup> assigned to the maintainer noise hazard to “very low” by basing the reduction, in part, on a flight deck crew rotation plan that was neither fully developed in its concept nor verified with the using organization (Commander, Naval Air Forces (CNAF)) as an effective mitigation measure as required by Military Standard 882D;
- Created a “very low” risk category for rating hazards, which JPO representatives stated is acceptable below the PM level. The JPO then rated the maintainer noise hazard in this “very low” category, contrary to updated guidance. The new risk category, by definition, reduces the amount of effort required to mitigate the risk, and the level of approval for risk acceptance; and
- Did not maintain a current log of mitigation efforts that included an assessment of the residual mishap risk associated with the maintainer noise hazard.

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<sup>2</sup> The JPO refers to RAC as Hazard Risk Index (HRI).

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b. **Noise Waiver.** We interviewed JPO representatives to verify the existence of a noise waiver for the JSF aircraft. We also obtained hazard analysis records relating to the noise hazard and reviewed mitigation efforts that were taken. We found no evidence that a noise waiver had been granted to the contractor for the JSF Program, nor was there a formal process to create and grant a waiver. The maintainer noise hazard had been identified as a “very low” risk, and the risk was in an “open” status.<sup>3</sup> JPO representatives stated that no official acceptance for a noise hazard risk was initiated.<sup>4</sup> Lack of a formal acceptance of a hazard and its residual mishap risk further validates that no formal waiver existed.

c. **System Safety Design Order of Precedence.** The JPO could not provide evidence that they first attempted to mitigate the maintainer noise hazard early in the program acquisition through design selection, before incorporating safety devices in 2001 when the JPO endorsed the SBIR project to develop hearing protection devices (see Enclosure 6). MIL-STD-882D, Section 4.4, System Safety Design Order of Precedence and the JPO’s own System Safety Program Plan, Section 5.3, require that identified hazards are eliminated through design selection, and then, if unable to do that, incorporate safety devices. The JPO did not require the contractors, in the contract specifications, to consider and/or incorporate design solutions to mitigate the maintainer noise hazard. According to JPO representatives, efforts to assess the hazardous noise issue began prior to entering into the SDD phase, and mature technologies were not available for incorporation into the propulsion system design within the constraints of operational effectiveness and suitability, time, and cost to reduce the system noise to a safe level. JPO representatives also stated that they were unable to produce evidence supporting this claim, which they believe was common knowledge within the USN aerospace engineering community prior to 2001. However, JPO representatives provided a “Joint F135/F136 Joint Strike Fighter Propulsion System Noise Reduction Feasibility Study Report” that was conducted by the two contractors who designed the JSF propulsion systems.

d. The study, dated 31 March 2006, started in September 2005 and was completed 5 years after endorsing the development of hearing protection devices to mitigate the hazardous noise. The study reported that there were no solutions which could provide significant noise reduction for the JSF without impacting the propulsion system, and found that the noise reduction concepts examined were relatively immature and a considerable amount of time may be required to mature discussed solutions for entry into service. According to JPO representatives, they will continue to seek out new technologies via SBIR and other programs for noise reduction, hearing protection devices, and new technology to perform functions currently being done by flight deck

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<sup>3</sup> As defined by the JPO, an “open” status indicates that all hazard controls required to achieve an acceptable risk index (Risk Assessment Code) have not yet been implemented.

<sup>4</sup> According to MIL-STD-882D, Section 4.7, the appropriate risk acceptance authority shall formally acknowledge and document acceptance of hazards and residual mishap risk.

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maintainers to manage remaining personnel exposure. While the JPO formally investigated the feasibility of noise reduction design solutions in 2005 and 2006, they first took a safety device approach to mitigate the maintainer noise hazard, which is contrary to the system safety design order of precedence. Table 1 lists each criterion and its requirements:

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Table 1

Criteria	Requirements
Military Standard 882D, Section 4.4	<p>Mishap risk mitigation is an iterative process that culminates when the residual mishap risk has been reduced to a level acceptable to the appropriate authority. The system safety design order of precedence for mitigating identified hazards is:</p> <ol style="list-style-type: none"> <li>1. <u>Eliminate hazards through design selection</u>: If unable to eliminate an identified hazard, reduce the associated mishap risk to an acceptable level through design selection.</li> <li>2. <u>Incorporate safety devices</u>: If unable to eliminate the hazard through design selection, reduce the mishap risk to an acceptable level using protective safety features or devices.</li> <li>3. <u>Provide warning devices</u>: If safety devices do not adequately lower the mishap risk of the hazard, include a detection and warning system to alert personnel to the particular hazard.</li> <li>4. <u>Develop procedures and training</u>: Where it is impractical to eliminate hazards through design selection or to reduce the associated risk to an acceptable level with safety and warning devices, incorporate special procedures and training. Procedures may include the use of personal protective equipment.</li> </ol>
JSF Program System Safety Program Plan, Section 5.3	<p>The order of precedence for satisfying system safety requirements and reducing hazard risk is as follows:</p> <ol style="list-style-type: none"> <li>1. <u>Design for Minimum Risk</u>. Design to eliminate the hazards is the preferred approach. If an identified hazard cannot be eliminated, reduce the associated risk to an acceptable level through design selection.</li> <li>2. <u>Incorporate Safety Devices</u>. If identified hazards cannot be eliminated or their associated risk adequately reduced through design, that risk shall be reduced through the use of fixed, automatic, or other protective safety design features or devices. Provisions shall be made for periodic functional checks of safety devices when applicable.</li> <li>3. <u>Provide Warning Devices</u>. When neither design nor safety devices can effectively eliminate identified hazards or adequately reduce associated risk, devices shall be used to detect the condition and to produce an adequate warning signal to alert personnel of the hazard. Warning signals and their application shall be designed to minimize the probability of incorrect personnel reaction to the signals and shall be standardized within like types of systems.</li> <li>4. <u>Develop Procedures and Training</u>. Where it is impractical to eliminate hazards through design selection or adequately reduce the associated risk with safety and warning devices, procedures and training shall be used. Procedures shall identify the need for personal protective equipment, if appropriate, and provide precautionary notations. Tasks and activities judged to be safety critical may require certification of personnel proficiency.</li> <li>5. <u>Assume Residual Hazard Risk</u>. When all appropriate action listed previously has been taken and it is impractical to reduce the remaining hazard risk to an acceptable level, a Program Manager and JPO decision must be made to assume this residual hazard risk.</li> </ol>

e. The JPO did not follow the system safety design order of precedence by first attempting to mitigate the maintainer noise hazard through design selection because the JPO lacked internal controls to ensure compliance with the system safety design order of

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precedence. JPO representatives stated that, when the ORD and contract specifications were written, no specific noise requirements were included. Section 5.3.5 of the JSF ORD, dated 13 March 2000, stated, “F-35 must minimize noise hazards to aircrew in the cockpit and personnel working around aircraft with running engines and minimize environmental impacts.” The ORD does not provide a specific noise threshold that the program office and contractors should meet or work toward. The section referencing noise in the contract specifications, which should be derived from the requirements in the ORD, is Section 3.2.1.1.1.4.5 which stated, “The JSF Air System shall provide communication and non-communication Hearing Protection Devices (HPDs) for maintainers (including ground and ship deck personnel) that meet the noise attenuation ... and communication ... performances.” This contract specification addressed the ORD requirement through a safety device approach rather than a design selection approach.

f. JPO representatives further stated it was not possible to reduce noise without compromising the intended performance and affordability of the JSF, and a quieter engine could not be achieved with the technology that was available at the time. However, the JPO representatives could not provide evidence that designing a quieter engine was explored at the beginning of the acquisition program in accordance with the design order of precedence. The “Joint F135/F136 Joint Strike Fighter Propulsion System Noise Reduction Feasibility Study Report” also concluded that the technology was not feasible for incorporation into the JSF aircraft. However, the study was performed by the contractors who designed the existing propulsion systems and was completed 5 years after: (1) the prototype designs had been developed and tested, and (2) the contract for production of the JSF aircraft had been awarded.

g. By not mitigating the identified maintainer noise hazard early in the program acquisition in accordance with the system safety design order of precedence, decision makers may not know whether design solutions to mitigate the maintainer noise hazard could have been developed and incorporated into the original design of the JSF by the prototype contractors. In addition, the results of the feasibility study were not available to decision makers to consider for incorporation into the design of the JSF aircraft until 5 years after the winning prototype was selected and the production contract had been awarded. DON decision makers did not have the opportunity to weigh the potential benefits of noise mitigation solutions versus the associated costs and aircraft performance reported in the study.

h. **Assignment of RAC.** The JPO inappropriately reduced the RAC initially assigned to the maintainer noise hazard. According to the 18 January 2008 hazard analysis record, the initial RAC for the maintainer noise hazard was Marginal and Probable (9). According to JPO's Risk Acceptance Policy, a RAC rating of 9 is considered a “medium” safety risk and was considered acceptable by the JPO Project Manager. As of 18 January 2008, the RAC for the maintainer noise hazard was further modified to Marginal and Improbable (17). A RAC rating of 17 is considered a “very

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low” safety risk and JPO representatives stated that this rating was considered acceptable by the System Safety Working Group (SSWG), which is below the PM level (see Table 2). JPO representatives stated that the RAC of 17 had not been formally reviewed by SSWG. As of 4 June 2008, the JPO SSWG still had not formally reviewed the RAC of 17. Assignment and use of the appropriate RAC to manage risk is critical because it directly impacts the visibility of the risk and its potential consequences, and determines how high in the chain of command the authority to accept the risk is vested.

i. According to the JPO, the JSF aircraft will expose at least three positions on the flight deck to noise levels that exceed safe noise exposure duration limits, even with the implementation of new technology hearing protection. Even in these conditions, JPO identified the risk of the maintainer noise hazard as “very low.” Issues with the assignment of RACs could be resolved by establishing more concrete guidance on evaluating, defining, and categorizing hazards and their residual risks, to ensure proper visibility and awareness of risks are maintained. This will be addressed in a future “Consideration of Safety and Occupational Health Issues in Acquisition” summary report by the Naval Audit Service.

j. The RAC reduction was inappropriate because the JPO employed a mitigation approach that was not agreed to by the ultimate end user (using organization), as advised by the MIL-STD-882D, Section A.4.4.5. In the case of the JSF, the “using organization” was CNAF, who reports to Commander, Fleet Forces Command (CFFC). Additionally, the JPO did not evaluate the maintainer noise hazard and associated mishap risk in close consultation and coordination with the using organization as advised by the MIL-STD-882D, Section A.4.4.8.1.2. JPO representatives stated that the RAC reduction of the maintainer noise hazard from “medium” to “very low” was based on mitigation efforts that consisted of a combination of new technology hearing protection and a planned rotation of the three flight deck positions exposed to levels of noise that exceed safe noise exposure duration limits. JPO representatives further stated that the rotation plan was not fully developed, or verified by the using organization as an effective mitigation measure. The plan was also not evaluated in close consultation and coordination with, or agreed to by the using organization. According to U.S. Pacific Fleet and CNAF representatives (who report to the CFFC), the rotation plan may or may not be a viable option. They stated that there are specific required qualifications for personnel filling positions on the flight deck, and only a limited number of people are authorized and available to fill them. They also stated that the rotation plan may expose even more people to the hazard if more personnel are required to implement the rotation plan requirements. Furthermore, a CNAF point of contact provided by the JPO stated that they were unaware of the flight deck crew rotation plan. According to MIL-STD-882D, close consultation and coordination with the ultimate end user is suggested to assure that the context of the user requirements, potential mission capability, and the operational environment, are adequately addressed. As a consequence, the

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rationale for reducing the RAC was based in part on a mitigation approach whose concept of employment and feasibility of implementation had yet to be determined, and had not been discussed with and agreed to by the using organization.

k. We asked the F/A-18E/F Program Office (PMA265) if they considered a plan to rotate flight deck personnel to mitigate hazardous noise exposure, as the F/A-18E/F aircraft will present a similar noise hazard to the JSF. PMA265 representatives told us they did not consider that mitigation approach, and their CNAF representative did not think it was feasible because the tradeoff would impair efficiency of flight deck operations to the point where mission accomplishment would be jeopardized. PMA265 initially assigned a RAC level of “serious” to the maintainer noise hazard, which is higher than the JPO’s initial RAC level of “medium” and their reduced rating level of “very low” for JSF. According to PMA265, the RAC assessment methodology included recognizing jet noise as a longstanding problem for Naval aviation. PMA265 referenced in their PESHE ongoing jet design and improved hearing protection noise reduction efforts. PMA265 appropriately maintained the RAC because they had not yet implemented mitigation solutions, and the risk was formally accepted at the PEO level, in accordance with SECNAVINST 5000.2C. Additionally, the residual risk was formally acknowledged by CNAF in a risk acknowledgement memo. As a result, the flight-line/deck jet noise hazard maintained appropriate awareness and visibility for the associated RAC of “serious.”

l. Under the JPO’s Risk Acceptance Policy, reducing the RAC assigned to the maintainer noise hazard to a “very low” risk level inappropriately exempted the JPO from requirements to proactively seek mitigation efforts. Additionally, the reduction reduced the visibility and awareness of the risk at higher command levels, and allowed acceptance of the hazard and its residual mishap risk at below the PM level, rather than a higher level of the chain of command.

m. **Risk Categories and Risk Acceptance Authority Levels.** The JPO established risk categories and risk acceptance authority levels that did not comply with updated guidance. The JPO created an additional risk category beyond that specified in SECNAVINST 5000.2C, Enclosure7, Section 7.3, which allowed hazards to be categorized as “very low,” and the maintainer noise hazard was placed in this category. Risk categories are a combination of severity<sup>5</sup> and probability<sup>6</sup> levels. In addition, the JPO’s risk acceptance authority levels allow hazards categorized as “low” to be accepted by the PM or a designee, which is also contrary to SECNAVINST 5000.2C, Enclosure7, Section 7.3. JPO representatives stated that hazards categorized as “very low” were acceptable and accepted by the SSWG, which is below the PM level. Accordingly, the

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<sup>5</sup> An assessment of the consequences of the most reasonable, credible mishap that could be caused by a specific hazard.

<sup>6</sup> The aggregate probability of occurrence of the individual events/hazards that might create a specific mishap.

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maintainer noise hazard (which was rated “very low” at the time of the audit) was categorized at a level of acceptance below the PM. This does not comply with DoDI 5000.2, Section E7.1.6 and SECNAVINST 5000.2C, Enclosure 7, Section 7.3. Specifically, the following tables illustrate the differences between the JPO’s risk categories and risk acceptance authority levels and those required by SECNAVINST 5000.2C:

**Table 2**

**JSF Program Office Risk Matrix**

Probability Severity	Frequent	Probable	Occasional	Remote	Improbable
Catastrophic (I)	1	2	4	8	11
Critical (II)	3	5	6	10	15
Marginal (III)	7	9	12	14	17
Negligible (IV)	13	16	18	19	20

Safety Risk	Risk Assessment Code	Decision Authority For Residual Risk
HIGH	1-3	Component Acquisition Executive (ASN (RD&A))
SERIOUS	4-7	Program Executive Officer or Equivalent
MEDIUM	8-10	JPO Program Manager or Equivalent
LOW	11	Acceptable Risk with review by JPO PM or designee
VERY LOW	12-20	Acceptable (SSWG)



\*Note: Red circle indicates the risk category & the black arrow indicates the risk acceptance authority level for the maintainer noise hazard.

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**Table 3**

<b>SECNAVINST 5000.2C Risk Matrix</b>					
Probability Severity	Frequent	Probable	Occasional	Remote	Improbable
Catastrophic (I)	High	High	High	Serious	Medium
Critical (II)	High	High	Serious	Medium	Medium
Marginal (III)	Serious	Serious	Medium	Medium	Medium
Negligible (IV)	Medium	Medium	Low	Low	Low

Risk Level	Risk Acceptance Authority
HIGH	ASN (RD&A)
SERIOUS	PEO/SYSCOM Commanders, or Flag -Level or SES designees
MEDIUM	Program Manager
LOW	Program Manager

\*Note: The colors were added for comparison purposes.

n. The JPO lacked internal controls to ensure compliance with the aforementioned guidance. The JPO’s Risk Acceptance Policy only recognized that the DoDI 5000.2 “...requires formal documentation of each management decision for the acceptance of safety risk and also specifies the Component Acquisition Executive and PEO shall approve acceptance of High and Serious safety risks respectively.” However, DoDI 5000.2, Section E7.1.6, also requires PM acceptance for “medium” and “low” risks. Furthermore, SECNAVINST 5000.2C, Enclosure 7, Section 7.3, states risk acceptance authority may not be delegated below the PM. The JPO included DoDI 5000.2 and SECNAVINST 5000.2C as risk acceptance policy and guidance; however, JPO representatives stated that the inclusion of this guidance was an error. They further stated that they were required to follow the previous versions of these instructions, DoDI 5000.2-R and SECNAVINST 5000.2B, which were in effect at the time the contract was awarded in 2001. We conclude that for the concern of the sailors, good business practice would require that the program be subjected to the more stringent policy, DoDI 5000.2 and SECNAVINST 5000.2C.

o. Establishing risk categories that were not compliant with updated guidance increases the potential of hazards and residual risks to be assessed in a manner that is inconsistent with other programs. This could limit DON leadership’s ability to properly evaluate Environmental, Safety, and Occupational Health risks and make effective risk management decisions. As a result of establishing risk acceptance authority levels that do not comply with updated guidance, a hazard and its residual mishap risk may not be visible and accepted at the appropriate risk acceptance authority level.

Subj: **CONSIDERATION OF HAZARDOUS NOISE IN THE ACQUISITION OF THE JOINT STRIKE FIGHTER (INTERIM AUDIT REPORT N2009-0013)**

p. **Tracking of Hazards and Residual Mishap Risk.** The JPO insufficiently tracked the maintainer noise hazard and residual mishap risk. Specifically, the JPO did not maintain a current log that included the assessment of residual mishap risk for the maintainer noise hazard throughout the system life cycle, as required by MIL-STD-882D, Sections 4.8 and A.4.4.8.1. The JPO established a database to track hazards; however, our analysis of the maintainer noise hazard reports from the hazard database showed that weaknesses existed within the tracking process. The hazard database was not regularly updated to reflect the current status of the maintainer noise hazard, the assessment of its residual mishap risk, and mitigation efforts related to the hazard. JPO representatives stated that mitigation efforts for the maintainer noise hazard (noise exposure to flight deck operators) through the development of advanced hearing protection had been ongoing since the program's inception (1996). While vendor test results for hearing protection supported the JPO's statements, the hazard analysis record generated from the hazard database on 18 January 2008 did not reflect these mitigation efforts and did not recognize maintainer noise as a hazard until September 2007. However, JPO representatives provided another hazard analysis record on 5 June 2008 that they stated came from the pre-SDD Preferred Weapon System Concept (PWSC) phase that showed an opening date of 22 May 1998. JPO representatives also stated that the hazard disappeared from the database around 2003 and could not explain why the hazard was not in the database until a new record was created in September 2007. The PWSC hazard analysis record had been modified to include entries dated 4 June 2008 because, according to JPO representatives, some of the original information had to be copied into new fields to be visible in the hazard analysis report format. As a result of these circumstances, we used the document dated September 2007 as support for the identified hazard.

q. This condition existed because the JPO lacked internal controls to ensure that a current log that included an assessment of residual mishap risk for the identified maintainer noise hazard was maintained. JPO representatives stated that tracking the current status of hazard mitigation was not relevant because noise hazard mitigation efforts would continue regardless of the information that was tracked in the database.

r. A concise, dated record of mitigation efforts and their associated effectiveness on reducing residual mishap risk is not readily available for program management review because of insufficiently tracking the maintainer noise hazard and the assessment of its residual mishap risk. This may limit management's ability to efficiently reference past efforts, associated levels of hazard severity and probability, and current initiatives, as well as develop future goals and milestones. Basing program decisions on incomplete and inaccurate information could lead to insufficient mitigation of noise and other hazards, contributing to a hazardous environment to the sailor.

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s. **Summary.** While safety and occupational health issues were addressed by the JPO during the acquisition process, the JPO did not provide evidence that they first attempted to mitigate the maintainer noise hazard early in the program acquisition through design selection; inappropriately reduced the RAC assigned to the maintainer noise hazard; did not follow updated guidance relating to risk categories and risk acceptance authority levels; and insufficiently tracked the maintainer noise hazard and the assessment of its residual mishap risk. These conditions may contribute to a hazardous environment of high noise exposure that, according to the Naval Safety Center, ensures permanent hearing loss to sailors. In addition to the personal cost to the sailor, the economic consequences of hearing impairment to the Navy include: lost time and decreased productivity; loss of qualified workers through medical disqualification; military disability settlements; retraining; and expenses related to medical treatment.

6. **Recommendations.** We recommend that the Program Executive Officer for the Joint Strike Fighter Program Office:

**Recommendation 1.** Document prior, ongoing, and future efforts to identify potential design solutions to mitigate identified hazards, and determine what additional mitigation efforts may be possible (whether in design, devices, or other methods) to further reduce the maintainer noise hazard.

**Management Response to Recommendation 1.** Concur. Noise as a hazard is currently being carried in the JSF System Safety database. In addition, in January 2009 after the next scheduled meeting of the System Safety Working Group, noise and its “agreed to” HRI will be carried in the JSF Technical Issues database which tracks current issues and provides the ability to store relevant information on past, present, and potential future mitigation efforts. The Technical Issues database is reviewed by the JSF Chief Engineer and Director of Engineering on a scheduled basis to ensure that risks are being worked to the fullest extent of technologies available.

**Naval Audit Service Comment on Management Response to Recommendation 1.** The management response and planned action does not fully meet the intent of the recommendation. Accordingly, the recommendation is undecided and is being elevated to the Assistant Secretary of the Navy for Research, Development, and Acquisition for reconsideration. While the JPO responded that they will track the noise hazard in the JSF Technical Issues database and have the ability to store relevant information on past, present, and potential future mitigation efforts, they did not address how they intended to determine what additional mitigation efforts may be possible to further reduce the maintainer noise hazard. Our intent was for the JPO to explain how they plan to determine this.

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**Recommendation 2.** Establish a Plan of Actions and Milestones to revise RAC, in coordination with, and with the agreement of all required parties, including the using organizations, to reflect the appropriate level of risk for the noise hazard to those involved with the operation and maintenance of the JSF.<sup>7</sup>

**Management Response to Recommendation 2.** Concur. The program is making some changes to better align occupational health hazards with all programmatic hazard risks (most of which are related to system safety) and ensure risk acceptance consistency and compliance with risk acceptance policy. The SSWG will meet in January 2009 to assess the maintainer noise hazard and assign an initial and controlled risk, which results in a projected HRI. This will establish the actual initial and modified risk levels, based on mitigations, to which the program will manage closure of the hazard. The JPO is pursuing appropriate measures to mitigate the hazard, including close collaboration with CNAF to address CONOPS for the three deck crew positions that cannot be mitigated through the new hearing protection devices. We will revise our System Safety Management Plan to detail the process for user concurrence with closed hazards coming out of SDD. The PESHE will be updated to support the MS C FRP decision in 2013, and will reflect the HRI for the maintainer noise hazard (near field noise) captured in the database at that time.

**Naval Audit Service Comment on Management Response to Recommendation 2.** The management response and planned action meets the intent of the recommendation. JPO management did not provide a target completion date. Therefore, we are assigning the JPO a target date of 28 February 2009 to provide NAVAUDSVC with documentation to support that they revised the RAC for the maintainer noise hazard in coordination with, and with the agreement of all required parties, including the using organizations, to reflect the appropriate level of risk to those involved with the operation and maintenance of the JSF. Specifically the documentation should note what the revised RAC is and whether the using organizations (e.g. CNAF) accepted/agreed with the mitigation approaches, to include the rotation plan, as viable solutions. [See our comment on the management response to Recommendation 3 that discusses and contrasts the JPO and the F/A-18 Program Office's RACs for the flight deck noise hazard, and its belief that the crew rotation option will not be feasible. Also, in contrast to the JPO's designation of the maintainer noise hazard as

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<sup>7</sup> This recommendation was change to be specific to the hazard we reviewed. The original recommendation was to "Establish a Plan of Actions and Milestones to revise RAC, in coordination with, and with the agreement of all required parties, including the using organizations, to reflect the appropriate level of risk for the noise hazard to those involved with the operation and maintenance of the JSF."

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“very low” risk the F/A-18 Program Office has designated the risk as “serious.”

**Recommendation 3.** Establish controls and provide oversight to ensure that the maintainer noise hazard risks and the feasibility and acceptability of future mitigation efforts are verified and accepted by the using organization prior to changing the RAC.

**Management Response to Recommendation 3.** Nonconcur. There is no need to establish a new process; a program process already exists to do this, i.e., straight-forward implementation of the Naval Air System Command (NAVAIR) System Safety Management process. Risk values are documented to show an initial assessment and a final assessment which accounts for planned hazard controls. These controls are reviewed for effectiveness and suitability of controlling risk and include verification activity during SDD to ensure projected risk is achieved. The using organizations are represented at this meeting and no hazard mitigation will be included in the determination of final assessment without user concurrence. In the case of the noise hazard, reducing risk by limiting personnel exposure time is a very credible risk reduction method, which was proven by analysis appropriate for the program maturity level. The final verification includes using actual hardware in the shipboard environment.

**Naval Audit Service Comment on Management Response to Recommendation 3.** The JPO’s management response to this recommendation is unclear and does not meet the intent of the recommendation. Accordingly, the recommendation is undecided and is being elevated to the Assistant Secretary of the Navy for Research, Development, and Acquisition for reconsideration. The JPO stated that a program process already exists to ensure that the feasibility and acceptability of future mitigation efforts are verified and accepted by the using organization prior to changing the RAC. However, our audit showed that there was no such process related to ensuring the user was consulted on and agreed with the feasibility of the proposed mitigation strategy of rotating crews to limit noise exposure. The JPO reduced the RAC associated with the maintainer noise hazard to “very low” risk without doing that coordination. JPO’s management responses stated that the final risk assessment accounts for planned hazard controls. Assignment and use of the appropriate RAC to manage risk is critical because it directly impacts the visibility of the risk and its potential consequences, and determines how high in the chain of command authority to accept the risk is vested. It would be inappropriate for decisionmakers to rely on a RAC that is based on a proposed mitigation strategy whose feasibility and likelihood of success has yet to be discussed with end users or verified.

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The JPO initially assigned a RAC of “medium” to the maintainer noise hazard, which was reduced to “very low” as a result of implementation of hearing protection and the rotation plan. Reducing the RAC to “very low,” based on mitigation that may not be feasible, lowered the risk acceptance authority to the SSWG level. A RAC rating at this level exempted the JPO from requirements to proactively seek mitigation for the maintainer noise hazard, which remains very high even after consideration of the use of hearing protection devices, and made the risk no longer visible to DON senior leaders involved with the program.

The noise hazard for JSF maintainer personnel will be substantial. In the best case, using the newest technology hearing protective devices, maintainer personnel will be exposed to noise levels substantially above the 84 dB level, which is considered hazardous to hearing. In addition to the use of hearing protection, the JPO decided to further mitigate the maintainer noise hazard by proposing a plan to rotate flight deck crews to limit exposure to the noise hazard. However, they made no effort to discuss this mitigation approach, which is a fundamental change to the present fleet concept of operations, with the ultimate end users who will have to implement the change. Further, it was inappropriate for the JPO to reduce the RAC associated with the maintainer noise hazard from “medium” to “very low” without close consultation and coordination with, and the agreement of, the end user as to the feasibility of implementing a rotation plan, as advised in MIL-STD-882D, Sections A.4.4.5 and A.4.4.8.1.2. Finally, consulting with the end user on risk mitigation approaches, particularly where the health and safety of Navy and Marine aircraft maintainers and ground crews are at risk, and where the mitigation approach involves a fundamental change in the end user’s concept of operations, just makes sound business sense. Besides the health and safety risk to the Navy and Marine personnel directly exposed to the noise hazard, there is the risk of adding a significant amount to the already substantial long-term costs of hearing loss-related health care.

We asked the F/A-18E/F Program Office (PMA265) if they considered a plan to rotate flight deck personnel to mitigate hazardous noise exposure, as the F/A-18E/F aircraft will present a similar noise hazard to the JSF. PMA265 representatives told us they did not consider that mitigation approach, and their CNAF representative did not think it was feasible. The CNAF representative stated that the tradeoff would impair efficiency of flight deck operations to the point where mission accomplishment would be jeopardized. PMA265 initially assigned a RAC level of “serious” to the

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maintainer noise hazard for the F/A-18E/F, which is higher than the JPO's initial RAC level of "medium" and their reduced rating level of "very low" for JSF. According to PMA265, the RAC assessment methodology included recognizing jet noise as a longstanding problem for Naval aviation. PMA265 referenced in their PESHE ongoing jet design and improved hearing protection noise reduction efforts. PMA265 appropriately maintained the RAC because they had not yet implemented mitigation solutions that would resolve the problem, and the risk was formally accepted at the PEO level, in accordance with SECNAVINST 5000.2C. Additionally, the residual risk was formally acknowledged by CNAF in a risk acknowledgement memo. As a result, the F/A-18E/F flight-line/deck jet noise hazard maintained appropriate awareness and visibility for the associated RAC of "serious," while essentially the same JSF risk was made invisible to decision makers through reduction of the RAC risk level to "very low."

We spoke with representatives from PACFLT and CNAF Headquarters, who stated that the rotation plan may or may not be a viable option. They stated that there are specific required qualifications for personnel filling positions on the flight deck, and only a limited number of people are authorized and available to fill them. They also stated that the rotation plan could have the unintended effect of exposing even more people to the hazard, if more personnel are required to implement the rotation plan requirements.

JPO's management response stated that planned hazard controls are reviewed for effectiveness and suitability of controlling risk and include verification activity during SDD to ensure projected risk is achieved. They further stated that the using organizations are represented at this meeting and no hazard mitigation will be included in the determination of final assessment without user concurrence. However, the JPO's original management response stated: "During System Development and Demonstration (SDD), the System Safety Working Group (SSWG) performs the function of assessing identified risks and assigns an HRI accordingly, without user participation. This process will evolve to incorporate user representation prior to deployment of the system" [See Exhibit 7]. JPO's current response contradicts their original response related to the existence of this process. Waiting to consult with end users just prior to deployment of the JSF may present fewer opportunities to mitigate the hazard if the rotation plan is found to be infeasible. Although formal acceptance is not required prior to fielding, the end user should be consulted to determine the feasibility of proposed mitigation efforts. That

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is particularly true in this case as the option proposed will require a change in operations. If the change is not feasible to the user, it should not be considered as a mitigation approach and the RAC should not be reduced. In our opinion, waiting to notify end users of the risk, and especially of the chosen mitigation approach, which may not be feasible, provides the end user with no other option but to accept the system and the approach at system acceptance. Our intent was for the JPO to consult with end users to assess the viability and feasibility of the mitigation approach. This process should also be conducted on all hazards that have mitigation approaches that involve end users.

**Recommendation 4.** Reestablish risk categories and risk acceptance authority levels in JSF policies and procedures to ensure compliance with updated policy, DoDI 5000.2, Section E7.1.6 and SECNAVINST 5000.2C, Enclosure 7, Section 7.3.

**Management Response to Recommendation 4.** Partially concur. Program execution will continue in accordance with policies in place at the time of program initiation and establishment of contract, which is appropriate. However, the JPO will implement policies and procedures that reestablish risk categories and risk acceptance authority levels in accordance with updated policy, DoDI 5000.2, Section E7.1.6 and SECNAVINST 5000.2C, Enclosure 7, Section 7.3 at the first feasible opportunity.

**Naval Audit Service Comment on Management Response to Recommendation 4.** The management response and planned action do not meet the intent of the recommendation. Accordingly, the recommendation is undecided and is being elevated to the Assistant Secretary of the Navy for Research, Development, and Acquisition for reconsideration. While the JSF Program was initiated before SECNAVINST 5000.2C was issued, JPO representatives stated throughout the course of the audit that their risk acceptance policy was based on this instruction. Our audit work showed that JPO was not compliant with the risk categories (matrix) and risk acceptance authority levels noted in SECNAVINST 5000.2C. In our opinion, the JPO could, and should, comply with the risk acceptance authority levels (acceptance at the PM level or above) immediately without adverse impact. In addition, it would be prudent for the JPO to comply with the risk categories and associated definitions noted in SECNAVINST 5000.2C to enable decisionmakers to assess their hazards and associated risks consistent with other programs.

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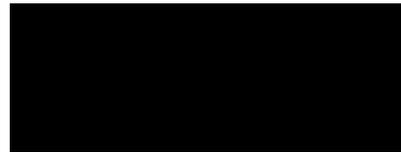
**Recommendation 5.** Establish controls and provide oversight to ensure that the current log of the identified maintainer noise hazard and an assessment of its residual mishap risk is updated and maintained.

**Management Response to Recommendation 5.** Concur. There was a hazard in the Concept Demonstration Phase database that was known but not well tracked throughout the development effort. The absence of that hazard in the SDD database did not affect how the mitigation path was executed, but the database will be updated to include it. The F-35 Hazard Risk Database will be updated to fully capture the maintainer noise hazard data tracked by the program.

**Naval Audit Service Comment on Management Response to Recommendation 5.** The management response and planned action meets the intent of the recommendation.

The JPO subsequently provided a target completion date of 15 April 2009 for the Hazard Risk Database update.

7. We appreciate the cooperation and courtesies extended to our auditors.



Assistant Auditor General  
Installations and Environment Audits

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THE JOINT STRIKE FIGHTER (INTERIM AUDIT REPORT N2009-0013)**

DIRECTOR AIR WARFARE (N88)

Enclosure 1:

# Status of Recommendations

Rec. No.	Page No.	Subject	Status <sup>8</sup>	Action Command	Target Completion Date
1	13	Document prior, ongoing, and future efforts to identify potential design solutions to mitigate identified hazards, and determine what additional mitigation efforts may be possible (whether in design, devices, or other methods) to further reduce the maintainer noise hazard.	U	ASN(RD&A)	1/15/09
2	14	Establish a Plan of Actions and Milestones to revise RAC, in coordination with, and with the agreement of all required parties, including the using organizations, to reflect the appropriate level of risk for the noise hazard to those involved with the operation and maintenance of the JSF.	O	JSF Program Executive Officer	2/28/09
3	15	Establish controls and provide oversight to ensure that the maintainer noise hazard risks and the feasibility and acceptability of future mitigation efforts are verified and accepted by the using organization prior to changing the RAC.	U	ASN(RD&A)	1/15/09
4	19	Reestablish risk categories and risk acceptance authority levels in JSF policies and procedures to ensure compliance with updated policy, DoDI 5000.2, Section E7.1.6 and SECNAVINST 5000.2C, Enclosure 7, Section 7.3.	U	ASN(RD&A)	1/15/09
5	20	Establish controls and provide oversight to ensure that the current log of the identified maintainer noise hazard and an assessment of its residual mishap risk is updated and maintained.	O	JSF Program Executive Officer	4/15/09

<sup>8</sup> / O = Recommendation is open with agreed-to corrective actions; C = Recommendation is closed with all action completed; U = Recommendation is undecided with resolution efforts in progress.

## Scope and Methodology

The broader audit of “Consideration of Safety and Occupational Health Issues in Acquisition of Major Department of Navy (DON) Weapons Systems and Platforms,” began on 10 August 2007 and is ongoing as of the date of this publication. Separate interim reports will be issued on each system audited, and a summary report summarizing the individual system reviews and identifying systemic issues will be issued upon completion of our audit work. We conducted this audit of the consideration of hazardous noise in the acquisition of the Joint Strike Fighter (JSF) between 13 November 2007 and 16 October 2008.

We verified that the JSF noise level posed a hazard to DON sailors and Marines and assessed the JSF Joint Program Office’s (JPO’s) process of mitigating these identified hazards. Specifically, we assessed the JPO’s mitigation efforts related to the maintainer noise hazard (noise exposure to flight deck operators).

We conducted site visits at Program Executive Office Crystal City, VA, and Naval Air Systems Command, Patuxent River, MD, and interviews with JPO Environmental, Safety, and Occupational Health personnel, JSF Environment Acoustics Team members, and Naval Air Systems Command Program Management Air 202 representatives to:

- Determine if the JSF noise level posed a hazard;
- Obtain evidence of an existing noise waiver for the JSF Program; and
- Assess the JPO’s process for mitigating the identified maintainer noise hazard.

We reviewed maintainer noise hazard reports from the hazard database, the Programmatic Environment, Safety, and Occupational Health Evaluation, the JSF Operational Requirements Document, JSF contract specifications, and test result documentation for hearing protection and noise levels.

We conducted this performance audit in accordance with Generally Accepted Government Auditing Standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

## Pertinent Guidance

Department of Defense Instruction (DoDI) 5000.2 “Operation of the Defense Acquisition System,” dated 12 May 2003, Section E7.1.6, states that the Component Acquisition Executive (CAE) is the acceptance authority for high Environmental, Safety, and Occupational Health mishap risks identified by the program. The Instruction adds that the Program Executive Office (PEO)-level is the authority for serious risks, and the Program Manager (PM) is the authority for medium and low risks, as defined in the industry standard for system safety.

Military Standard 882D (MIL-STD-882D), “Standard Practice for System Safety,” dated 10 February 2000, outlines a standard practice for conducting the Department of Defense (DoD) system safety approach and managing safety and health mishap risks in order to meet the DoD commitment to protecting private and public personnel from accidental death, injury, or occupational illness. Section A.4.4.5 advises a program to reduce system mishap risk through a mitigation approach mutually agreed to by the developer, program manager, and using organization. Section A.4.4.8.1.2 states that the PM will evaluate the hazards and associated mishap risk in close consultation and coordination with the ultimate end user, to assure that the context of the user requirements, potential mission capability, and the operational environment are adequately addressed.

- Section 4.4 states that mishap risk mitigation is an iterative process that culminates when the residual mishap risk has been reduced to a level acceptable to the appropriate authority. The system safety design order of precedence for mitigating identified hazards is defined in this section. See the “Criterion and Requirements” table in the System Safety Design Order of Precedence section on page 5 for details.
- Section 4.8 requires a program to track hazards, their closures, and residual mishap risk. A tracking system for this information must be maintained throughout the system life cycle. The program manager must keep the system user apprised of this information. Section A.4.4.8.1 states each system must have a current log of identified hazards and residual mishap risk, including an assessment of the residual mishap risk. As changes are integrated into the system, this log is updated to incorporate added or changed hazards and the associated residual mishap risk. The Government must formally acknowledge acceptance of hazards and residual risk and keep users informed of hazards and residual mishap risk associated with their systems.

Secretary of the Navy Instruction (SECNAVINST) 5000.2C, “Implementation and Operation of the Defense Acquisition System and the Joint Capabilities Integration and

Development System,” dated 19 November 2004, Enclosure 7, Section 7.3, includes the following risk acceptance authority levels:

- High risks: Assistant Secretary of the Navy (Research, Development, and Acquisition) (ASN (RD&A));
- Serious risks: PEO/Systems Command (SYSCOM) commanders, or flag-level or senior executive service (SES) designees/Direct Reporting Program Managers (DRPM), Chief of Naval Research (CNR); and
- Medium/low risks: PMs. Risk acceptance authority may not be delegated below the PM.

Office of the Chief of Naval Operations Instruction (OPNAVINST) 5100.23G, “Navy Safety and Occupational Health (SOH) Program Manual,” dated 30 December 2005, Section 1801a, states that occupational hearing loss resulting from exposure to hazardous noise, the high cost of related compensation claims, and the resulting drop in productivity and efficiency highlight a significant problem that requires considerable attention. Noise control and hearing conservation measures contribute to operational readiness by preserving and optimizing auditory fitness for duty in Navy personnel. The instruction defines a potentially hazardous noise area as any work area where the A-weighted sound level (continuous or intermittent) is greater than 84 dBs.

JSF System Safety Program Plan, dated 25 May 2005, Section 5.3, states that the order of precedence for satisfying system safety requirements and reducing hazard risk is as follows: design for minimum risk, incorporate safety devices, provide warning devices, develop procedures and training, and then assume residual hazard risk.

# Safe Noise Exposure Duration Limits



## Value to the Warfighter

ENHANCED  
WARFIGHTER  
HEARING

### Quantifiable Enhancement Safe Noise Exposure Duration Limits Wearing Progressively Higher Attenuating Hearing Protection

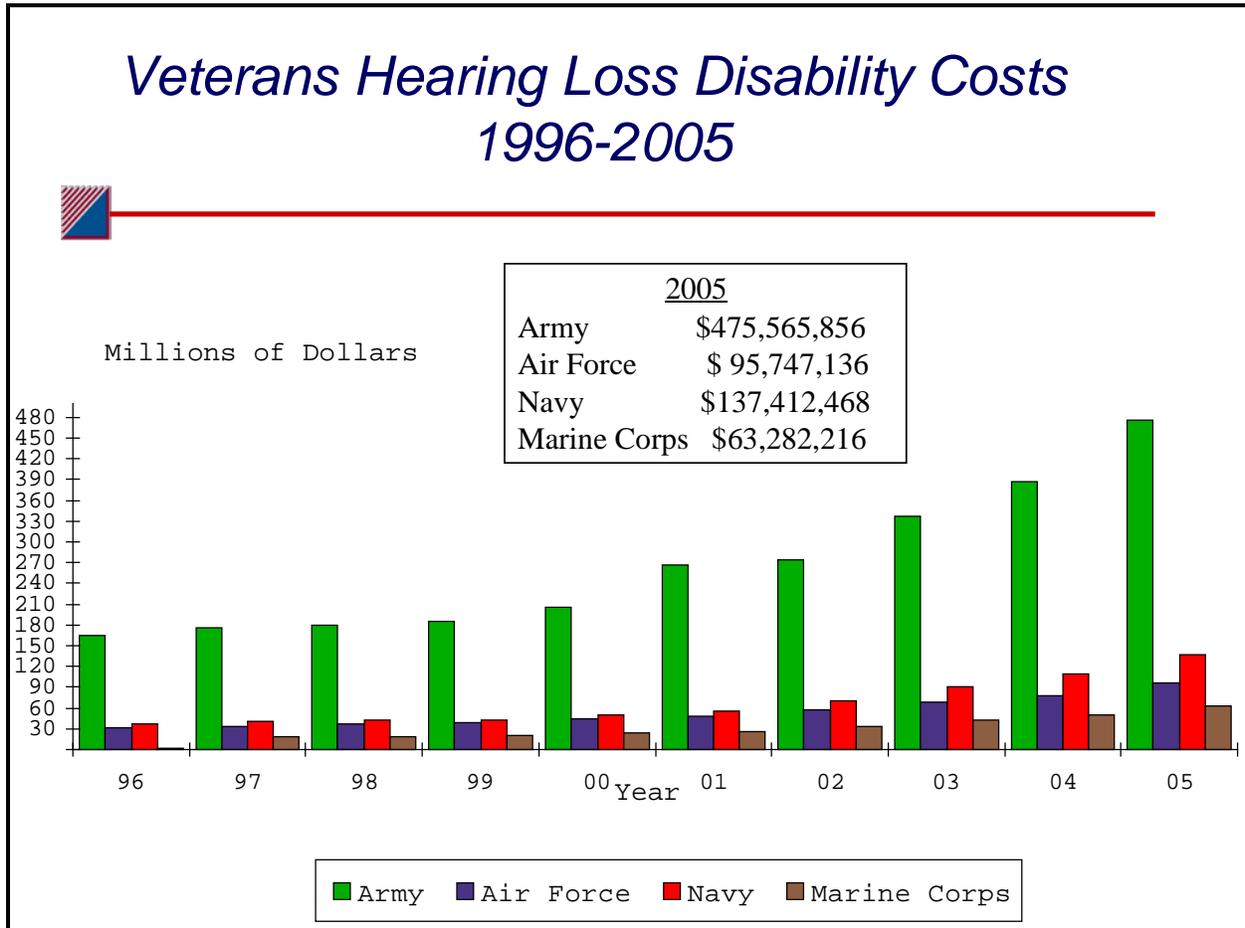
Jet Noise Level Prevalent on Flight Deck (dBA)	Unprotected	Current Flight Deck Helmet + Foam Earplugs	Improved Earcups + Custom Solid Earplugs	Improved Earcups + Active Noise Reduction Earplugs
	≈ 0 dB protection	≈ 30 dB protection	≈ 43 dB protection	≈ 50 dB protection
151	<b>Exceed Safe Exposure Immediately</b>	7 sec	2 min 22 sec	11 min 54 sec
148		14 sec	4 min 44 sec	23 min 49 sec
145		28 sec	9 min 27 sec	47 min 37 sec
142		56 sec	18 min 54 sec	1 hr 35 min 15 sec
139		1 min 53 sec	37 min 48 sec	3 hrs 10 min 29 sec
136		3 min 45 sec	1 hr 15 min 36 sec	6 hrs 20 min 59 sec
133		7 min 30 sec	2 hrs 31 min 11 sec	<b>SAFE</b>
130		1 sec	15 min	5 hrs 2 min 23 sec

Per DoD Instruction 6055.12 Hearing Conservation, an 8 hour average noise exposure should not exceed 85 dBA and for every 3 dBA above this, exposure time should be halved. This exchange rate was used to calculate safe exposure durations in this table.

Source: Joint Strike Fighter Program Office, “Programmatic Environment, Safety, and Occupational Health Evaluation,” March 2007.

Enclosure 5:

# Center for Naval Analyses Veterans Hearing Loss Disability Costs

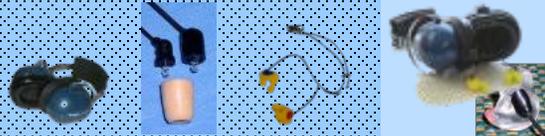


Source: Center for Naval Analyses, "Computing the Return on Noise Reduction Investments in Navy Ships: A Life-Cycle Cost Approach," September 2006.

# Hearing Protection Suite



## Hearing Protection Roadmap

CURRENT		NEAR-TERM			FUTURE
<b>Components</b>	<b>Integrated</b>	<b>Components</b>			<b>Integrated</b>
<p><i>Hearing protection using foam type devices varies depending on properly wearing both earplugs</i></p> <p>21 dB Mean Attenuation Legacy Earmuff</p> <p>22 dB Mean Attenuation Legacy Foamy Earplugs</p> 		25 dB Mean Attenuation Improved Earmuff	28 dB Mean Attenuation Foam Tip Mini-Comm Earplug (CEP)	29 dB Mean Attenuation Custom Molded Deep Insert Earplug	<p>43 dB Mean Attenuation</p> <p>Improved Earmuff + Custom Molded Deep Insert Earplug</p> <p>w/ or w/o Communication</p> 
<p>30 dB Mean Attenuation</p> <p>Legacy Earmuff + Legacy Foamy Earplugs</p> 		<p>43 dB Mean Attenuation</p> <p>Improved Earmuff + Custom Molded Deep Insert Earplug</p> <p>w/ or w/o Communication</p> 			<p>50 dB Mean Attenuation</p> <p>Active Noise Reduction (ANR) + Improved Earmuff + Custom Molded Deep Insert Earplug</p> <p>w/ or w/o Communication</p> 
<b>Legacy Cranial</b>		<b>Flight Deck Cranial Program</b>			

1. Naval personnel correctly wearing both Legacy Foamy Earplugs = 7%, results in 22 dB protection.  
 2. Naval personnel with shallow insertion or not wearing Legacy Foamy Earplugs = 79%, results in 0-6 dB protection.



Source: Program Manager Air – Naval Aircrew Systems (PMA 202), “Flight Deck Cranial Status Brief to the NESB,” 25 March 2008.

# Original Management Response From Program Executive Officer, Joint Strike Fighter



## JOINT STRIKE FIGHTER PROGRAM

200 12th Street South, Suite 600  
Arlington, Virginia 22202-5402



SEP 10 2008

Mr. Ron J. Booth  
Assistant Auditor General, Installations and Environment Audits  
Naval Audit Service, Department of the Navy  
1006 Beatty Place SE  
Washington Navy Yard, DC 20374-5005

Dear Mr. Booth:

This is the F-35 Program Office response to the Naval Audit Service (NAVAUDSVC) Draft Interim Audit Report on Consideration of Hazardous Noise in the Acquisition of the Joint Strike Fighter, dated 14 August 2008 (N2007-NIA000-0066.002).

The F-35 Program Office non-concurs with the basic premise of the NAVAUDSVC draft report, i.e., that the F-35 Program did not attempt to mitigate the maintainer noise hazard early in the acquisition process, inappropriately reduced the Hazard Risk Index (HRI) assigned to the maintainer noise hazard, and did not follow updated guidance relating to risk categories and risk acceptance authority levels. The March 2006 "Joint F135/F136 Joint Strike Fighter (JSF) Propulsion System Noise Reduction Feasibility Study Report" reconfirmed that no mature technology to reduce F-35 engine noise was available at the time of program initiation and is still not available. That same report demonstrates that the F-35 Program continuously assesses technologies that might reduce known hazards and address high visibility issues. In addition, the Naval Air System Command (NAVAIR) System Safety Division lead confirmed to the NAVAUDSVC that the program's Hazard Risk Management processes comply with NAVAIR's expectations.

The F-35 Program is integrating the world's most powerful tactical fighter engine into the latest 5<sup>th</sup> generation strike fighter weapon system. The Program is using available technology to meet the warfighter needs stated in the F-35 Operational Requirements Document (ORD). Recognizing the limitations of current technology to reduce engine noise, the F-35 Program was proactive in maturing hearing protection technology to mitigate noise hazards to Navy personnel. Specifically, the F-35 Program funded development efforts to reduce the "near field noise" experienced by ground/flight deck crew and maintainers. The F-35 Program was instrumental in getting that improved hearing protection fielded to protect Navy personnel from all hazardous carrier flight deck noise sources as soon as possible and long before F-35 enters the fleet. Asserting that the F-35 Program did not do enough to mitigate the noise hazard ignores significant accomplishments that benefit the entire fleet, other Services, and Partner nations.

Program Office comments on the draft report recommendations follow.

**Recommendation 1.** Document prior, ongoing, and future efforts to identify potential design solutions to mitigate identified hazards, and determine what additional mitigation efforts may be possible (whether in design, devices, or other methods) to further reduce the maintainer noise hazard.

**Program Office Comment:** Partially concur. While there is no formal documentation library for these efforts, e.g. a database, the program is already meeting the intent of this recommendation. As evidenced in the "Joint F135/F136 JSF Propulsion System Noise Reduction Feasibility Study Report", dated 31 March 2006, the JPO continuously looks at technologies that might reduce known hazards and address high visibility issues. That report, which was provided to the audit team, reconfirmed that no mature technology to reduce F-35 engine noise was available at the time of program initiation or now. However, the F-35 Hazard Risk Database will be updated to fully capture the maintainer noise hazard data tracked by the program.

**Recommendation 2.** Establish a Plan of Actions and Milestones to revise Risk Assessment Code (RAC) in coordination with, and with the agreement of all required parties, including the using organizations, to reflect the appropriate level of risk for occupational safety and health risks, including the noise hazard to those involved with the operation and maintenance of the JSF.

**Program Office Comment:** Non-concur. A program process already exists to do this. During System Development and Demonstration (SDD), the System Safety Working Group (SSWG) performs the function of assessing identified risks and assigns an HRI accordingly, without user participation. This process will evolve to incorporate user representation prior to deployment of the system. When user commands begin accepting operational system, acceptance of unmitigated hazards will need to have user concurrence. The near-field noise hazard (maintainer noise) is no different from any other hazard accepted during SDD. In many cases mitigations are on-going, but those that have no further mitigation actions will be addressed in the user concurrence process prior to fleet introduction.

**Recommendation 3.** Establish controls and provide oversight to ensure that the maintainer noise hazard risks and the feasibility and acceptability of future mitigation efforts are verified and accepted by the using organization prior to changing the Risk Assessment Code (RAC).

**Program Office Comment:** Non-concur. A program process already exists to do this, i.e., straight-forward implementation of the Naval Air Systems Command (NAVAIR) System Safety Management process. Risk values are documented to show an initial assessment and a final assessment which accounts for planned hazard controls. These controls are reviewed for effectiveness and suitability of controlling risk and include verification activity during SDD to ensure projected risk is achieved. In the case of the noise hazard, reducing risk by limiting personnel exposure time is a very credible risk reduction method, which was proven by analysis appropriate for the program maturity level. The final verification includes using actual hardware in the shipboard environment. No user input is required for this decision; however user input will be sought for detailed implementation regarding personnel and operational requirements.

**Recommendation 4.** Reestablish risk categories and risk acceptance authority levels in JSF policies and procedures to ensure compliance with updated policy, DoDI 5000.2, Section E7.1.6 and SECNAVINST 5000.2C, Enclosure 7, Section 7.3.

**Program Office Comment:** Partially concur. Program execution continues in accordance with policies in place at the time of program initiation, which is appropriate. Updated DoD policies will be evaluated for incorporation in subsequent phases of the program.

**Recommendation 5.** Establish controls and provide oversight to ensure that the current log of the identified maintainer noise hazard and an assessment of its residual mishap risk is updated and maintained.

**Program Office Comment:** Concur. There was a hazard in the Concept Demonstration Phase database that was known but not well tracked throughout the development effort. The absence of that hazard in the SDD database did not affect how the mitigation path was executed, but the database will be updated to include it.



Charles R. Davis, Maj Gen, USAF  
Program Executive Officer

# NAVAUDSVC Rebuttals to Original Management Response From Program Executive Officer, Joint Strike Fighter

**Recommendation 1.** Document prior, ongoing, and future efforts to identify potential design solutions to mitigate identified hazards, and determine what additional mitigation efforts may be possible (whether in design, devices, or other methods) to further reduce the maintainer noise hazard.

**Management Response to Recommendation 1.** Partially concur. While there is no formal documentation library for these efforts, e.g. a database, the program is already meeting the intent of this recommendation. As evidenced in the “Joint F135/F136 JSF Propulsion System Noise Reduction Feasibility Study Report,” dated 31 March 2006, the JPO continuously looks at technologies that might reduce known hazards and address high visibility issues. That report, which was provided to the audit team, reconfirmed that no mature technology to reduce F-35 engine noise was available at the time of program initiation or now. However, the F-35 Hazard Risk Database will be updated to fully capture the maintainer noise hazard data tracked by the program.

**Naval Audit Service Comment on Management Response to Recommendation 1.** The management response and planned action does not meet the intent of the recommendation. Accordingly, the recommendation is undecided and is being elevated to the Assistant Secretary of the Navy for Research, Development, and Acquisition for reconsideration. While the feasibility study report, dated 31 March 2006, indicated that the concepts examined in the study were not mature for entry into service at that time, it does not show that JPO continuously looks at technologies that might reduce known hazards. It only supports that an effort was made beginning in 2005 and ending in 2006. JPO representatives could not provide documentation to support efforts made before or since 2005/2006 to identify potential solutions to mitigate identified hazards. Further, the 2006 study was performed by the contractors who designed the existing propulsion systems and was completed 5 years after: (1) the prototype designs had been developed and tested, and (2) the contract for production of the JSF aircraft had been awarded. JPO’s management response states that the Hazard Risk Database will be updated by 15 April 2009. Our intent was for the JPO to

continue to seek mitigation efforts that may be available to further mitigate the maintainer noise hazard and for JPO to document these efforts.

The JPO subsequently provided a target completion date of 15 April 2009 for the Hazard Risk Database update.

**Recommendation 2.** Establish a Plan of Actions and Milestones to revise RAC, in coordination with, and with the agreement of all required parties, including the using organizations, to reflect the appropriate level of risk for occupational safety and health risks, including the noise hazard to those involved with the operation and maintenance of the JSF.

**Management Response to Recommendation 2.** Non-concur. A program process already exists to do this. During System Development and Demonstration (SDD), the System Safety Working Group (SSWG) performs the function of assessing identified risks and assigns an HRI accordingly, without user participation. This process will evolve to incorporate user representation prior to deployment of the system. When user commands begin accepting operational system, acceptance of unmitigated hazards will need to have user concurrence. The near-field noise hazard (maintainer noise) is no different from any other hazard accepted during SDD. In many cases mitigations are on-going, but those that have no further mitigation actions will be addressed in the user concurrence process prior to fleet introduction.

**Recommendation 3.** Establish controls and provide oversight to ensure that the maintainer noise hazard risks and the feasibility and acceptability of future mitigation efforts are verified and accepted by the using organization prior to changing the RAC.

**Management Response to Recommendation 3.** Nonconcur. A program process already exists to do this, i.e., straight forward implementation of the Naval Air System Command (NAVAIR) System Safety Management process. Risk values are documented to show an initial assessment and a final assessment which accounts for planned hazard controls. These controls are reviewed for effectiveness and suitability of controlling risk and include verification activity during SDD to ensure projected risk is achieved. In the case of the noise hazard, reducing risk by limiting personnel exposure time is a very credible risk reduction method, which was proven by analysis appropriate for the program maturity level. The final verification includes using actual hardware in the shipboard environment. No user input is required for this decision; however user input will be sought for detailed implementation regarding personnel and operational requirements.

**Naval Audit Service Comment on Management Response to Recommendations 2 and 3.** The JPO's management responses to these recommendations are unclear and do not meet the intent of the recommendations. The management responses to Recommendations 2 and 3 state that a program process already exists to coordinate their mitigation approaches with end users. However, JPO management later stated in a subsequent e-mail to their management responses that the process would be outlined by June 2009 and user input would be sought preparatory to initial deployment in 2015. Therefore, throughout the course of this audit, there was no formal process in place. JPO's management responses stated that the final risk assessment accounts for planned hazard controls. Assignment and use of the appropriate RAC to manage risk is critical because it directly impacts the visibility of the risk and its potential consequences, and determines how high in the chain of command authority to accept the risk is vested. It would be inappropriate for decision makers to rely on a RAC that is based on a proposed mitigation strategy whose feasibility and likelihood of success has yet to be discussed with end users or verified.

The JPO initially assigned a RAC of "medium" to the maintainer noise hazard, which was reduced to "very low" as a result of implementation of hearing protection and the rotation plan. Reducing the RAC to "very low," based on mitigation that may not be feasible, lowered the risk acceptance authority to the SSWG level. A RAC rating at this level exempted the JPO from requirements to proactively seek mitigation for the maintainer noise hazard, which remains very high even after consideration of the use of hearing protection devices, and made the risk no longer visible to DON senior leaders involved with the program.

The noise hazard for JSF maintainer personnel will be substantial. In the best case, using the newest technology hearing protective devices, maintainer personnel will be exposed to noise levels substantially above the 84 dB level, which is considered hazardous to hearing. In addition to the use of hearing protection, the JPO decided to further mitigate the maintainer noise hazard by proposing a plan to rotate flight deck crews to limit exposure to the noise hazard. However, they made no effort to discuss this mitigation approach, which is a fundamental change to the present fleet concept of operations, with the ultimate end users who will have to implement the change. JPO representatives told us they are not required by any regulatory guidance to present the mitigation alternative to the fleet until just prior to fielding at system acceptance. We disagree. MIL-STD-882D, Section A.4.4.8.1.2 states that the PM should evaluate the hazards and associated mishap risk in close consultation and coordination with the ultimate end user. Further, it was inappropriate for the JPO to

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reduce the RAC associated with the maintainer noise hazard from “medium” to “very low” without close consultation and coordination with, and the agreement of, the end user as to the feasibility of implementing a rotation plan, as advised in MIL-STD-882D, Sections A.4.4.5 and A.4.4.8.1.2. Finally, consulting with the end user on risk mitigation approaches, particularly where the health and safety of Navy and Marine aircraft maintainers and ground crews are at risk, and where the mitigation approach involves a fundamental change in the end user’s concept of operations, just makes sound business sense. Besides the health and safety risk to the Navy and Marine personnel directly exposed to the noise hazard, there is the risk of adding a significant amount to the already substantial long-term costs of hearing loss-related health care.

We asked the F/A-18E/F Program Office (PMA265) if they considered a plan to rotate flight deck personnel to mitigate hazardous noise exposure, as the F/A-18E/F aircraft will present a similar noise hazard to the JSF. PMA265 representatives told us they did not consider that mitigation approach, and their CNAF representative did not think it was feasible. The CNAF representative stated that the tradeoff would impair efficiency of flight deck operations to the point where mission accomplishment would be jeopardized. PMA265 initially assigned a RAC level of “serious” to the maintainer noise hazard for the F/A-18E/F, which is higher than the JPO’s initial RAC level of “medium” and their reduced rating level of “very low” for JSF. According to PMA265, the RAC assessment methodology included recognizing jet noise as a longstanding problem for Naval aviation. PMA265 referenced in their PESHE ongoing jet design and improved hearing protection noise reduction efforts. PMA265 appropriately maintained the RAC because they had not yet implemented mitigation solutions that would resolve the problem, and the risk was formally accepted at the PEO level, in accordance with SECNAVINST 5000.2C. Additionally, the residual risk was formally acknowledged by CNAF in a risk acknowledgement memo. As a result, the F/A-18E/F flight-line/deck jet noise hazard maintained appropriate awareness and visibility for the associated RAC of “serious,” while essentially the same JSF risk was made invisible to decision makers through reduction of the RAC risk level to “very low.”

We spoke with representatives from PACFLT and CNAF Headquarters, who stated that the rotation plan may or may not be a viable option. They stated that there are specific required qualifications for personnel filling positions on the flight deck, and only a limited number of people are authorized and available to fill them. They also stated that the rotation plan

could have the unintended effect of exposing even more people to the hazard, if more personnel are required to implement the rotation plan requirements.

The JPO's official management response stated: "During System Development and Demonstration (SDD), the System Safety Working Group (SSWG) performs the function of assessing identified risks and assigns an HRI accordingly, without user participation. This process will evolve to incorporate user representation prior to deployment of the system." By waiting to consult with end users just prior to deployment of the JSF, there may be fewer opportunities to mitigate the hazard if the rotation plan is found to be infeasible. Although formal acceptance is not required prior to fielding, the end user should be consulted to determine the feasibility of proposed mitigation efforts. That is particularly true in this case as the option proposed will require a change in operations. If the change is not feasible to the user, it should not be considered as a mitigation approach and the RAC should not be reduced. In our opinion, waiting to notify end users of the risk, and especially of the chosen mitigation approach, which may not be feasible, provides the end user with no other option but to accept the system and the approach at system acceptance. Our intent was for the JPO to consult with end users to assess the viability and feasibility of the mitigation approach. This process should also be conducted on all hazards that have mitigation approaches that involve end users.

The JPO should immediately revise the maintainer noise hazard RAC to reflect the appropriate high level of risk.

We consider Recommendations 2 and 3 in this report to be undecided and are elevating them to Assistant Secretary of the Navy for Research, Development, and Acquisition (ASN (RD&A)) for reconsideration.

**Recommendation 4.** Reestablish risk categories and risk acceptance authority levels in JSF policies and procedures to ensure compliance with updated policy, DoDI 5000.2, Section E7.1.6 and SECNAVINST 5000.2C, Enclosure 7, Section 7.3.

**Management Response to Recommendation 4.** Partially concur. Program execution continues in accordance with policies in place at the time of program initiation, which is appropriate. Updated DoD policies will be evaluated for incorporation in subsequent phases of the program.

**Naval Audit Service Comment on Management Response to Recommendation 4.** The management response and planned action do not

meet the intent of the recommendation. Accordingly, the recommendation is undecided and is being elevated to the Assistant Secretary of the Navy for Research, Development, and Acquisition for reconsideration. While the JSF Program was initiated before SECNAVINST 5000.2C was issued, JPO representatives stated throughout the course of the audit that their risk acceptance policy was based on this instruction. Our audit work showed that JPO was not compliant with the risk categories (matrix) and risk acceptance authority levels noted in SECNAVINST 5000.2C. In our opinion, the JPO could, and should, comply with the risk acceptance authority levels (acceptance at the PM level or above) immediately without adverse impact. In addition, it would be prudent for the JPO to comply with the risk categories and associated definitions noted in SECNAVINST 5000.2C to enable decision-makers to assess their hazards and associated risks consistent with other programs.

The JPO subsequently provided a target completion date of approximately 2012 for evaluation of updated DoD policy for incorporation in Milestone C, which is planned for 2014. A target date that far in the future for revising ESOH risk policy is unrealistically long and reflects a lack of urgency to address the identified problem.

**Recommendation 5.** Establish controls and provide oversight to ensure that the current log of the identified maintainer noise hazard and an assessment of its residual mishap risk is updated and maintained.

**Management Response to Recommendation 5.** Concur. There was a hazard in the Concept Demonstration Phase database that was known but not well tracked throughout the development effort. The absence of that hazard in the SDD database did not affect how the mitigation path was executed, but the database will be updated to include it. The F-35 Hazard Risk Database will be updated to fully capture the maintainer noise hazard data tracked by the program.

**Naval Audit Service Comment on Management Response to Recommendation 5.** The management response and planned action meets the intent of the recommendation.

The JPO subsequently provided a target completion date of 15 April 2009 for the Hazard Risk Database update.

# Revised Management Response From Program Executive Office, Joint Strike Fighter

This information was submitted to the Assistant Auditor General, Installation and Environment Audits Directorate via e-mail 2 December 2008 from the Director of Engineering, F-35 Lightning II.

**Recommendation 1.** Document prior, ongoing, and future efforts to identify potential design solutions to mitigate identified hazards, and determine what additional mitigation efforts may be possible (whether in design, devices, or other methods) to further reduce the maintainer noise hazard.

**Management Response to Recommendation 1.** Concur. Noise as a hazard is currently being carried in the JSF System Safety database. In addition, in January 2009 after the next scheduled meeting of the System Safety Working Group, noise and its "agreed to" HRI will be carried in the JSF Technical Issues database which tracks current issues and provides the ability to store relevant information on past, present, and potential future mitigation efforts. The Technical Issues database is reviewed by the JSF Chief Engineer and Director of Engineering on a scheduled basis to ensure that risks are being worked to the fullest extent of technologies available.

**Recommendation 2.** Establish a Plan of Actions and Milestones to revise RAC, in coordination with, and with the agreement of all required parties, including the using organizations, to reflect the appropriate level of risk for the noise hazard to those involved with the operation and maintenance of the JSF.

**Management Response to Recommendation 2.** Concur for the specific instance. The only finding to substantiate this recommendation was a discrepancy in the value of the HRI for noise between the ESOH and System Safety database. As a result of the disconnect between ESOH and System Safety practices, the program is making some changes to better align occupational health hazards with all programmatic hazard risks (most of which are related to system safety) and ensure risk acceptance consistency and compliance with risk acceptance policy. The SSWG will meet in January 2009 to assess the maintainer noise hazard and assign an initial and controlled risk, which results in a projected HRI. This will establish the actual initial and modified risk levels, based on mitigations, to which the program will manage closure of the hazard. The JPO is pursuing appropriate measures to mitigate the hazard, including close collaboration with CNAF to address CONOPS for the three deck crew positions that cannot be mitigated through the new hearing protection devices. We will revise our System Safety Management Plan to detail the process for user concurrence with closed hazards coming out of SDD. The PESHE will be updated to support the MS C FRP decision in 2013, and will reflect the HRI for the maintainer noise hazard (near field noise) captured in the database at that time

**Recommendation 3.** Establish controls and provide oversight to ensure that the maintainer noise hazard risks and the feasibility and acceptability of future mitigation efforts are verified and accepted by the using organization prior to changing the RAC.

**Management Response to Recommendation 3.** Non-concur. There is no need to establish a new process, a program process already exists to do this, i.e., straight-forward implementation of the Naval Air System Command (NAVAIR) System Safety Management process. Risk values are documented to show an initial assessment and a final assessment which accounts for planned hazard controls. These controls are reviewed for effectiveness and suitability of controlling risk and include verification activity during SDD to ensure projected risk is achieved. The using organizations are represented at this meeting and no hazard mitigation will be included in the determination of final assessment without user concurrence. In the case of the noise hazard, reducing risk by limiting personnel exposure time is a very credible risk reduction method, which was proven by analysis appropriate for the program maturity level. The final verification includes using actual hardware in the shipboard environment.

**Recommendation 4.** Reestablish risk categories and risk acceptance authority levels in JSF policies and procedures to ensure compliance with updated policy, DoDI 5000.2, Section E7.1.6 and SECNAVINST 5000.2C, Enclosure 7, Section 7.3.

**Management Response to Recommendation 4.** Partial-concur. Program execution will continue in accordance with policies in place at the time of program initiation and establishment of contract, which is appropriate. However, the JPO will implement policies and procedures that reestablish risk categories and risk acceptance authority levels in accordance with updated policy, DoDI 5000.2, Section E7.1.6 and SECNAVINST 5000.2C, Enclosure 7, Section 7.3. at the first feasible opportunity.