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The Special Counsel

December 6, 1999

The President  
The White House  
Washington, D.C. 20500

Re: OSC File No. 98-1434

Dear Mr. President:

In accordance with 5 U.S.C. § 1213(e)(3), I am transmitting a report from the Honorable Daniel S. Goldin, Administrator, National Aeronautics and Space Administration (NASA), sent to me pursuant to 5 U.S.C. §§ 1213(c) and (d). The report sets forth the findings and conclusions of the Administrator's review of disclosures of information allegedly evidencing a substantial and specific danger to public health and safety within the Space Shuttle Program at NASA, Lyndon B. Johnson Space Center (JSC), Houston, Texas.

The whistleblower, Mary D. Harris, provided comments on the agency report to this office pursuant to 5 U.S.C. § 1213(e)(1), which I am also transmitting.

We have carefully examined the original disclosures and reviewed the agency's response and Ms. Harris' comments. Pursuant to 5 U.S.C. § 1213(e)(2), I have determined that the findings in the NASA report are reasonable and contain all of the information required by statute.

Ms. Harris, who consented to the release of her name, is an Electromagnetic Interference (EMI) Analyst with the Avionics Systems Division at JSC. She alleged that officials at JSC have created and are perpetuating a serious risk to public safety, such as the in-flight failure of a space shuttle, by ignoring their own specifications and safety margins for the effects of electromagnetic interference between and among systems within a given space shuttle, called "critical boxes,"<sup>1</sup> and from sources external to the system. She alleged that for a period of ten years, from 1989 to the present, NASA has allowed various vehicles to be sent into space when the EMI levels of the vehicles exceeded the established safety margin. This

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<sup>1</sup> NASA Space Shuttle Program Requirements for EMI, found in a document entitled "Specification, Electromagnetic Compatibility Requirement, SL-E-0001," defines critical equipment as all subsystems, equipment or functions installed in or associated with the system, the failure or unintended operation of which could cause loss of life or injury to flight or ground crew, and/or loss or extensive damage to the flight vehicle or ground facility. SL-E-0001, Section 3.2.2. The specification SL-E-0001 also establishes the EMI safety margin of less than 6dB. SL-E-0001, Section 3.2.3.

practice, Ms. Harris maintains, creates cause for concern that at some point, a critical shuttle component or system will fail, and the shuttle will crash because of this failure.

The NASA report is a comprehensive, detailed, and highly technical response to each of Ms. Harris' specific allegations, and to her overall concerns about the Electromagnetic Control (EMC) discipline within the Space Shuttle Program. In formulating its response, NASA brought together a review team (the Electromagnetic Effects (EME) Review Team), employing the expertise of six individuals, including both NASA employees and outside consultants. The report concluded that although no "specific danger to public health and safety," or violations of law, rule, or regulation were found, areas for improvement in the Space Shuttle program EME process and documentation, and the need for specific requirement changes, were identified.

The EME Review Team determined that while the Space Shuttle EMC processes generally adhere to standard industry practices, some processes and recordkeeping are in need of improvement. The report identified the need for improvement in the areas of requirement control, consistency of technical approach and in data and recordkeeping. The report assigned the following actions for implementation: (1) completion of an external radio frequency environment study; (2) implementation of new susceptibility test specifications for future hardware procurement; (3) determination of the need to re-test heritage hardware given new susceptibility test specifications; and (4) performance of another system-level EMC compliance assessment to verify that no significant degradation has occurred in meeting the 6 dB margin of safety, updating the last system-level assessment performed in the late 1980s.

It should be noted that these actions parrot the four issues identified in Ms. Harris' White Paper, identified as the "Number 1 Issue: The 6-dB Safety Margin." The NASA report identifies Ms. Harris' major concern as the inability to quantitatively verify the system margin of safety, and the failure to determine the exact safety margin. Although the EME Review Team did not agree with Ms. Harris' suggested methodology for assessing system safety, they did recommend the implementation of improvements to the EMC processes. Notwithstanding this difference of opinion, the report recommends the verification of system EMC by (1) performing another system-level EMC assessment, using new or supplemental tests and analyses as appropriate; (2) updating EMC requirements as needed and applying the requirements to new avionics; and (3) evaluating all existing safety-critical Space Shuttle hardware to determine if a retest is needed against the new requirements.

Further, NASA has represented that it will institute, within the Space Shuttle Program, a standard system analysis approach for all future EMC/EMI waivers. The NASA report acknowledges that the EMC analysis approaches employed by the various Space Shuttle EMC analysts are not consistent. In addition, the report admits that the waiver process was inadequately handled until April 1998. Based on its findings, NASA has represented that it will: (1) improve EMC waiver recordkeeping; (2) institute a standard system analysis approach for all future EMC/EMI waivers; (3) complete EMC test and qualification data

records, including historical records, to enable an audit of installed hardware qualifications; and (4) assure that the functions vested in the EMC Board required by SL-E-0001, are performed, including providing for oversight and coordination.

With respect to the data and documentation required to conduct appropriate EMC analysis, NASA acknowledges that updating is needed, and that historical test data are sometimes unavailable because records are inadequately maintained. NASA has already updated some information, and plans to update the system and element EMC control plans. NASA has also pledged to verify that appropriate resources are applied to the EMC program. The NASA report concluded that "while not all of Ms. Harris's allegations were substantiated, many of her concerns were valid and will result in enhancement to the Space Shuttle EMC program."

Ms. Harris asserts that although she attempted on several occasions to clarify the EME Review Team's misinterpretation of her methodology for properly assessing EMC confidence for the Space Shuttle, the report distorts her formula by exaggerating the suggested safety margin beyond what she believes is reasonable. In addition, she states that the report addresses only part of the proposed methodology outline. According to Ms. Harris, the outline addressed up to four levels of analysis, with the top level assessing the probability of meeting the system safety margin. Proceeding through the four levels of the outline, conducting the analysis with more detail and refinement at each level, ensures that the safety margin is met.

She asserts that she has not expressed the need to know the "exact" safety margin, but rather that NASA should know the susceptibility limits of its critical equipment. The susceptibility or immunity levels should allow calculation of the safety margin against the changing EMI environment, both internal and external, in which the Shuttle operates. She maintains that it is possible to achieve this type of systems-level testing of the Shuttle, pre-flight, despite NASA's contention that the most feasible way to test the entire system, with all contributing factors, is actual flight.

Ms. Harris has provided point-by-point comments on the conclusions reached in the NASA report. Generally, she and NASA are at odds with respect to the *process* for system-level verifications. She did acknowledge in conversation with the OSC that if NASA implemented the measures proposed in the report, the Space Shuttle Program would be heading in the right direction. She is not currently aware of any improvements or the implementation of any of the actions identified in the report. Copies of her comments are enclosed with this correspondence.

I have determined, pursuant to section 1213(e)(2), that the agency's report contains the information required under section 1213(d), and that the findings of the agency head appear to be reasonable, for the reasons stated above.

As required by section 1213(e)(3), I have sent a copy of the report and Ms. Harris'

The Special Counsel

The President

Page 4

comments to the Chairman of the Senate Committee on Commerce, Science and Transportation, and the Chairman of the House Committee on Science. We have also filed a copy of the transmittal in our public file and closed the matter.

Respectfully,



Elaine Kaplan

Enclosures