DEPARTMENT OF THE AIR FORCE
HEADQUARTERS SPACE AND MISSILE SYSTEMS CENTER (AFMC)
LOS ANGELES, CA

11 April 2001

MEMORANDUM FOR PEO/SP
SAF/AQ
USD (AT&L)

FROM: SMC/MT
185 Discoverer Blvd, Suite 2512
El Segundo, CA 90245-4695

SUBJECT: SBIRS Program Office Response to GAO Report

1. SMC/MT does not concur with the recommendations of the draft GAO report on the Air Force Space Based Infrared System-High, titled "Defense Acquisitions: Risk Associated with Space-Based Missile Warning Need to be Addressed," (GAO code 707559). This report is not completely accurate, and its conclusions, recommendations, and basic premises have been overcome by events.

2. The incorrect premises are identified in the following paragraphs.

a. GAO Claim: The DSP capabilities may deteriorate before SBIRS High satellites are scheduled to launch.

b. SMC/MT response: The GAO report paints a bleaker picture than is actually the case.

(1) The DSP life expectancy is understated in Figure 1 (page 12) and in the accompanying life expectancy discussion (page 13). Using design and actual life of previous satellites, we derive a 25-percent longer life expectancy than that stated in the text of the report. As such, the report's conclusions represent a scenario that does not reflect historical on-orbit experience.

(2) Additionally, the SPO has taken prudent steps to maximize DSP on-orbit constellation life as well as the life of those satellites yet to be launched. For instance, we have repeatedly submitted budget requests that argue for a robust trending and anomaly resolution capability that we feel is key to realizing the maximum utility and life from each on-orbit DSP satellite. Such trending and anomaly resolution has also yielded valuable insights allowing the SPO to make hardware modifications and process changes to those assets awaiting launch: fixing potential problems and maximizing satellite life before ever leaving the ground.

(3) The AFSPC estimate of 12-15 months would appear to be based upon classical satellite experiences. Current planned test time for the GEO 1 satellite and sensor is significantly less than 1 year. It is based upon the concept of incremental build-up of testing as ground

facilities come on line and the constellation is deployed. Additionally, since GEO 1 will not be the first of the new sensors, experiences acquired during IHEO will benefit the GEO program.

c. GAO Claim: Timely transition from DSP to SBIRS High is in jeopardy due to ground software ability to support first launch. The Increment issues are used as a basis for this claim.

d. SMC/MT response: The GAO claim is incorrect because the stated assumptions and rationale contain errors.

(1) The GAO assumptions imply certification of ground software is required one year prior to launch. This is not accurate. A partial delivery of Increment 2 software will be required to support launch and early testing for the following areas: completing system integration tests, developing technical orders for the operational system, accomplishing crew training, and conducting crew drills in preparation for launch. It is the certification of nondegraded DSP performance that needed to be accomplished when the Increment 2 code was delivered, not GEO software certification.

(2) The SPO and contractor plan to launch GEO 1 and 2 satellites in a non-operational environment, operated by a mix of contractor and government personnel assigned to the SBIRS Combined Task Force (CTF), to conduct Launch and Early Orbit Test (L&EOT) in a manner similar to the L&EOT of HEO. The satellites and sensors will be operated using controlled "non-operationally certified" software in an engineering environment. This concept facilitates investigation and resolution of minor spacecraft discrepancies without any impact to ongoing DSP mission operations. Upon completion of L&EOT, the satellites will be transferred to the operational control of AFSPC. By that time, Increment 2 software will be operationally certified and available for AFSPC operations. This incremental fielding approach is low risk and incorporates successful experience from Increment 1 and a variety of other software programs.

(3) The CTF personnel will have gained significant experience with the HEO sensor and the HEO ground software. This experience will feed into the Increment 2 software builds supporting the GEO spacecraft and sensors. Taken together, incremental builds, initial operations in an engineering environment, and real world experience closely integrated with software development activities, provide robust risk mitigation for Increment 2 development and certification activities.

e. GAO Claim: Timely transition to SBIRS High is in jeopardy due to technical problems with the sensor and satellite development.

f. SMC/MT response: The GAO claims incorrectly characterize the risks to SBIRS High, and the identified items are largely already resolved.

(1) As with any new system of this magnitude and complexity there is development risk; however, none of the previous or current in-work technical issues are expected to impact the launch dates for SBIRS High. The Air Force acknowledges that initial SBIRS High space segment hardware design, integration and test has and is bound to continue to experience its share of development issues. SBIRS is proactively managing all aspects of the program to ensure the HEO-1 payload meets its Feb 02 delivery to the host for integration and GEO-1 meets an Oct

04 launch. Delivery of HEO-1 has not slipped from Feb 02 to May 02 as is stated in the report. Similarly, we are continuing to finalize the GEO design and will hold payload and space vehicle Critical Design Reviews (CDRs) in Jun 02. This schedule supports an Oct 04 launch.

(2) There are significant milestones with associated risk still ahead; but the risk-reduction efforts to date are beginning to reap tangible benefits. We have had several performance tests that exceeded expectations in critical radiometric and line-of-sight (LOS) performance areas. Specifically, focal-plane detector sensitivity is currently at 30% better than specification, and subsystem LOS testing indicates compliance with some stringent LOS knowledge requirements. To alleviate concerns regarding the specific items called out by the GAO report, the following updates are provided.

g. GAO Claim: Design changes to correct for gyroscope life issues will induce greater program risk and cause launch schedule delays.

h. SMC/MT Response: The Common Gyro Reference Assembly (CGRA) life issue will be resolved without any impact to the host delivery or launch date.

(1) The solution in place uses a combination of design and operational improvements with supporting testing and analysis, and demonstrates the CGRA will provide the reliability and performance needed for the planned HEO lifetime. The design improvements can be separated into two categories:

a. Increased and improved frame electrical isolation in concert with additional radiators to lower the average operation temperatures.

b. Insertion of protective shields to prevent plasma deposits from collecting on the mirror surfaces. This design modification is expected to yield a 2X-4X improvement in terms of both life and reliability. Life testing of this new design will be complete in August 2001, but present results justify confidence that the life issue will be successfully resolved.

(2) All hardware design changes are implemented in HEO1 and will support the current schedule.

i. GAO Claim: Changes to the sensor may be required in order to fix a HEO host-induced jitter problem. If not corrected for, the sensor may not be able to satisfy its missile warning requirements. Vibration due to the GEO bus would prevent the sensor from meeting theater missile-warning requirements.

j. SMC/MT Response: The jitter, a.k.a, base motion, problem is well on its way to being resolved. It will not require any sensor modifications and it will not impact our ability to meet missile-warning requirements.

(1) The GAO's categorization of HEO base motion as the vibrations caused by moving or reorienting the sensor is not accurate. The main issue is the spacecraft structure and the amount of jitter it places at the interface of the SBIRS payload due to disturbances caused by the host control-motion gyro actuators. Incremental development and maturity of dynamic structural

models on both sides of the interface reveal base motion is not the issue of the magnitude once thought. The capabilities of the host are much better than first postulated and the disturbances SBIRS can tolerate are greater than previously anticipated. Trends of both models over the past 14 months show convergence of both host capabilities and SBIRS allowable disturbance levels. Coupled structural analysis of the host vehicle and payload are scheduled to be completed in August 01. It is expected that these results will show a condition that is acceptable to both programs. In addition, the host is tightening balancing requirements on the control-moment gyros to lessen the disturbance, and the wheel speeds can be tuned on orbit to further reduce any residual base motion disturbances. We remain convinced that we will not see anywhere near the levels currently specified in the interface specification and that SBIRS will meet its mission performance requirements.

(2) Present analysis indicates GEO base motion effects do not impact SBIRS ability to meet mission performance requirements. Furthermore, GEO mathematical models will be correlated to results of a representative structural jitter test currently scheduled for the fall of CY02.

k. GAO Claim: The delay of CDR [to redesign for the off-axis rejection (stray light)] increases the risk of delaying the launch of the first SBIRS High GEO satellite.

l. SMC/MT Response: The redesign for the off-axis rejection (stray light) has been accomplished, and it is no longer an issue. The delay in the CDR has been accommodated in an updated schedule, and the new schedule supports the first SBIRS High GEO Launch.

(1) The stray light (off-axis rejection) had been a significant issue since 1999 , as was mentioned in the report. In 2000 we were still struggling with getting both an accurate measurement of the problem and solutions for improving it. As a result of the stray light measurement and its adverse impact on system Probability of Warning (Pw), we have since changed from a plane flyer to a solar flyer spacecraft orientation, which always blocks the sun from the telescope FOV. This essentially eliminated the GEO off-axis rejection issue, and it was removed from the payload specification.

(2) The increase in GEO performance allows us to meet our Pw requirements for both North America and Theater and improves sensitivity for our Technical Intelligence mission.

3. Thus, contrary to the GAO report conclusions, the Air Force has, and will continue to, actively pursue aggressive program management efforts to avoid the risk of degraded ballistic missile early warning capability. The GAO recommendation to develop a contingency plan that specifies actions to be taken in response to, and that considers the potential for, such degradation is overcome by events. The effort on this would be better served maintaining activities toward pursuit of a timely transition.

Very Respectfully

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MICHAEL W. BOOEN, Col, USAF
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Space Based Infrared Systems