

**National Security and
International Affairs Division**

B-250335

October 1, 1992

The Honorable Frank Horton
Ranking Minority Member
Committee on Government Operations
House of Representatives



147712

Dear Mr. Horton:

As you requested, we examined the evidence used by Theodore A. Postol, a Professor of Science, Technology, and National Security Policy at the Massachusetts Institute of Technology to determine that the Patriot missile system was ineffective during Operation Desert Storm. Specifically, our objective was to determine whether the videos produced by television crews could be used to conclusively prove that the Patriot did not hit any Scud missiles.

On September 21, 1992, we briefed your staff on our review. This letter provides the results of our review.

BACKGROUND

Professor Postol testified before two congressional committees, published an article in the winter 1991/1992 edition of International Security magazine, and participated in several interviews on the performance of the U.S. Army Patriot Missile System during the Persian Gulf War. Professor Postol states that during the war the Patriot was not as effective as claimed by the U.S. Army, did not destroy any of the Scud missile's warheads, and did not reduce the damage in the areas of Israel that it was sent to protect.

Professor Postol's conclusions are based on information from sources in Saudi Arabia, Israel, the U.S. Army Central Command, the Pentagon, newspapers, and videos produced by the television crews on site during the Persian Gulf War. The Professor relies heavily on videos produced by the television networks as support for his position that the Patriot missile was ineffective against the Scud missile warhead.

GAO/NSIAD-93-22R Postol's Video Analysis

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RESULTS IN BRIEF

The videos produced by the television crews cannot be relied upon as a data source to reach conclusions on how many Scud missiles were hit or missed by the Patriot during the Persian Gulf War. Experts from academia and industry explained to us why these videos are insufficient and of inadequate quality to make such conclusions. Government experts also told us that conclusion cannot be accurately determined by using videos of the quality produced by network television cameras.

VIDEO TAPES ANALYSIS BASED
ON ASSUMPTIONS AND THEORY

Professor Postol reviewed more than 140 video tapes and stated that there were 31 observable incidents of the Patriot attempting to intercept a Scud missile. Professor Postol stated that there were 24 clear misses and 7 incidents where the Patriot missile warhead detonated and the fireball covered the target vehicle. Of these 7 incidents, Professor Postol asserts that there were 2 hits with the possibility of a third hit. The Professor also stated that there were no indications from the videos that the Patriot missile destroyed a Scud missile warhead, even the two that were hits.

For those Patriot missiles that reached an intercept point and detonated their warheads, Professor Postol estimates that the Patriot missile missed the Scud missile by distances ranging from less than 50 meters to more than 1,800 meters. This wide range of estimated miss distances was determined based on an assumed speed of the Scud missile or Scud warhead and the use of estimated values, such as missile velocity and hot gas expansion rate, in a formula to arrive at an estimate of the Patriot's fireball size and travel distance. Of particular note is the estimate of the radius of the ball of hot gas created by the detonation of the Patriot's high explosive warhead--5 to 8 meters. The latter was used as a fixed reference point in space to measure the distance between the detonation of the Patriot warhead and the Scud missile.

For the seven incidents where the Patriot's warhead detonation obscured the target Scud, Professor Postol concludes that the fireball produced by the detonation of the Patriot warhead had an apparent diameter of more than 100 meters. However, he further concludes that just

because the fireball obscured the target it does not prove that the Patriot hit the Scud.

For the two or possibly three incidents that Professor Postol believes to be hits, his conclusion is based on the change in intensity of light reflected from the target as it emerges from the fireball and is carried forward by momentum. In two of the incidents, Professor Postol claims that ground explosions can be seen in the video after the hit, indicating that the warhead had not been destroyed.

EXPERTS CONCLUDE VIDEO TAPES
INADEQUATE TO JUDGE PERFORMANCE

According to electro-optical experts in academia, industry, and the U.S. Army and analysts in the Congressional Research Service and the Center for Strategic and International Studies, the video tapes cannot be relied upon to reach conclusions about the performance of the Patriot missile in the Persian Gulf War. They cited the following reasons:

- Observations from video tapes are inherently inaccurate because they lack depth, they provide poor image quality, and the Patriot and Scud missiles are not visible in the night background.
- The recording rate of the video cameras--30 frames per second--is too slow to capture the high speed events needed to interpret Patriot/Scud engagements. The frame rate for cameras used during performance testing of the Patriot missile system records at rates of 120 to 250 frames per second. For example, the experts estimate that the relative position of the two objects can change up to 70 meters during the time it takes to generate one video field with the type of cameras used to record the Patriot/Scud engagements.
- Determination of miss distance is not possible from a single camera site using only the information recorded by that camera.
- The "apparent diameter of more than 100 meters" stipulated by Professor Postol as the size of the fireball produced by the detonation of a Patriot missile is incorrect. Officials at White Sands Missile Range provided a photograph of a Patriot during daytime testing that shows a burst pattern of about ten meters.

-- The video tapes do not show complete engagements. A member of the media stated that he doubted that anyone got a clean shot of any of the engagements. Industry officials said that they were told by the media that the tapes were pooled and that some splicing of the tapes may have taken place. As a result, the video tapes may be showing segments from different engagements.

SCOPE AND METHODOLOGY

In performing our work, we reviewed the statements of Professor Postol and others on "Lessons for SDI from the Gulf War Patriot Experience." The statements were given before the House Armed Services Committee on April 16, 1991. We also reviewed Professor Postol's article entitled "Lessons of the Gulf War Experience with Patriot," which appeared in the winter 1991/1992 edition of International Security, and his April 17, 1992 statement before the House Government Operations Committee entitled "Optical Evidence Indicating Patriot High Miss Rates During the Gulf War." We reviewed a rebuttal to Professor Postol's article in International Security by Robert M. Stein (Manager of Advanced Air Defense Programs, the Raytheon Company), which appeared in the summer 1992 edition of International Security; selected videos assembled by Professor Postol; a video produced by a member of the Electro-optics Department at the Massachusetts Institute of Technology; an analysis of the networks video footage by the Materiel Test Directorate, White Sands Missile Range, New Mexico; correspondence between Professor Postol and the Center for Strategic and International Studies; Professor Postol's September 1992 report to the House Government Operations Committee entitled "An Evaluation of the Army Report 'Analysis of Video Tapes to Assess Patriot Effectiveness' Dated March 31, 1992;" and journal, newspaper, and magazine articles covering Professor Postol's statements and the opinion of others on the conclusion by Professor Postol on the effectiveness of the Patriot missile system.

We interviewed Professor Postol and members of industry involved in the production and testing of the Patriot missile system, the U.S. Army Patriot Program Management Office, the Center for Strategic and International Studies, the test community at White Sands Missile Range, and the television media that supported or participated in the recording of the Patriot/Scud engagements in the Persian Gulf War. We did not perform a technical review of the videos.

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We conducted our review from July 1992 to September 1992 in accordance with generally accepted government auditing standards. We did not obtain fully coordinated Department of Defense comments on this letter. However, we did discuss the information in the letter with officials at the Department of Defense and with Professor Postol. They generally agreed with our findings and we have incorporated their comments where appropriate.

We plan no further distribution of this letter until 10 days from its issue date. At that time, we will send copies to the Chairman of the House Committee on Government Operations, the Secretaries of Defense and the Army, Professor Postol, and other interested parties. We will also make copies available to others upon request.

Please contact me at (202) 275-4141 if you or your staff have any questions concerning this letter.

Sincerely yours,



Henry L. Hinton Jr.
Director, Army Issues

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