



National Security and  
International Affairs Division

B-282371

April 15, 1999

The Honorable Floyd Spence  
Chairman, Committee on Armed Services  
House of Representatives

Hydra 70 Rocket: Recent Performance Has Improved

Dear Mr. Chairman:

In fiscal years 1992-95, an unusually high incidence of a potentially dangerous problem occurred while the military services trained with and tested the Hydra 70 rocket. This problem, which is known as early motor blow (EMB), prevents the rocket from reaching its target and can cause damage to or loss of the aircraft and its crew. Only 1 EMB occurred between 1984 and 1991, but 15 occurred during fiscal years 1992-95.

The services have taken action to identify and eliminate the causes of early motor blows. At your request, we identified those actions and investigated the present performance of the Hydra 70 rocket.

RESULTS IN BRIEF

The services acted effectively to address the problem of early motor blows. After three EMBs caused damage to aircraft in 1992-93, the Naval Surface Warfare Center, as the design agent for the rocket, launched an independent investigation to determine their cause. Subsequently, the Army Industrial Operations Command, as program manager for the rocket, identified corrective actions. These actions included

- (1) improving the inspection process,
- (2) identifying authorized procedures for making changes to the rocket manufacturing process,
- (3) redesigning the die used to form the rocket's propellant,
- (4) establishing criteria to remove from inventory any propellant grain dropped during handling, and

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- (5) inspecting rockets already in inventory to screen out those that contain defective propellant grain.

The services began to implement these solutions in 1995, and, as of March 1999, they have reported only one EMB. Service officials estimate that the services fire about 270,000 Hydra 70 rockets each year. Hydra 70 program officials told us that the probability of an early motor blow occurring now meets the standard of one chance in a million.

### BACKGROUND

The Hydra 70 rocket consists of a motor and various types of warheads. The motor uses a propellant grain that is currently manufactured by Alliant Techsystems Ordnance Group at the Radford Army Ammunition Plant in Radford, Virginia. Under normal circumstances, the Hydra 70 propellant grain burns for about 1 second after ignition; an EMB occurs when the grain explodes less than .5 second after ignition. In an early motor blow, the rocket motor tube generally splits longitudinally, breaking into a few large pieces or exploding into many fragments of unburned propellant. An EMB is dangerous for the aircraft and crew because it occurs close to the aircraft.

Beginning in February 1991, Radford Army Ammunition Plant replaced its 100 percent x-ray inspection plan of the Hydra 70 rocket propellant grain with a sampling inspection plan. According to plant officials, a sampling process was implemented to meet an increased demand for rockets during Desert Storm.

The Army, Special Operations Forces, the Marine Corps, the Navy, and the Air Force fire Hydra 70 rockets from various platforms. The Army Industrial Operations Command in Rock Island, Illinois, assumed full responsibility for program management of the Hydra 70 rocket in September 1991. The Indian Head Division of the Naval Surface Warfare Center is the design agent for the Hydra 70 rocket motor.

### Actions Taken to Identify and Eliminate Causes of Early Motor Blows

At the urging of the Hydra 70 Program Management Office, the Indian Head Division of the Naval Surface Warfare Center chartered an independent investigation team that determined the probable causes of the 3 EMBs that had damaged aircraft in the 1992-1993 period. In October 1994, following 10 more EMBs, the Army suspended use of the training rockets with grain produced by the Radford plant.

In May 1994, the investigation team reported that the probable causes of the three EMBs studied were propellant grain fissures and propellant grain cracks. Fissures occur during manufacturing as a result of poor consolidation of the propellant as it is

extruded through a die to form the rocket grain. Cracks are caused when a rocket is dropped (dropping can occur during the manufacturing process or when the rocket is handled in the field). To prevent such failures, the team recommended that an independent review of the propellant grain manufacturing process be conducted to determine the causes of fissures, cracks, and poor consolidation of the grain. The team also recommended 100 percent rotational x-ray of the grain. A blue-ribbon panel authenticated the findings of the investigation team in March 1995.

A System Safety Risk Assessment report prepared in February 1995 by the Army Industrial Operations Command identified actions to eliminate the EMB problem. These actions which have been implemented included,

- (1) improving inspections through a refined process of ultrasound inspection of 100 percent of the propellant grain and further x-ray evaluation of suspicious grain,
- (2) Identifying the authorized procedure for making changes to the manufacturing process for the grain by analyzing and then classifying each process,
- (3) redesigning the die used to form the propellant grain, and
- (4) establishing criteria to remove from inventory any grain dropped during handling.

In addition, the services' inventories of Hydra 70 rockets and motors are being inspected to screen out those that have defective grain. The Navy and the Marine Corps are screening all their existing inventory at Indian Head; as of February 1999, about 90,000 remained to be screened. As of February 1999, the Air Force had approximately 136,600 uninspected rockets, but the Army was in the process of arranging for their inspection through an extension of its current inspection contract.

Officials at the Hydra 70 Program Management Office estimated that, as of March 1999, about 550,000 rockets for all users had been x-rayed. The Army estimates that about 170,000 Hydra 70 rockets to be used by the Army remained to be screened. They anticipate screening about 70,000 of these rockets before completing the current screening contract. Of the nearly 100,000 Army rockets not currently scheduled for screening, about 59,000 will be inaccessible before the current contract ends in about November 1999. Of these inaccessible rockets, about 24,000 are prepositioned on ships and another approximately 35,000 are positioned overseas. Also, about 40,000 training rounds are being stored in the United States. Officials at the Hydra 70 Program Management Office said they expect that the extension of the inspection contract to accommodate inspection of the Air Force's inventory will also allow for inspection of the Army's 40,000 training rounds and for some of the Army's rockets prepositioned afloat. The current cost to x-ray inspect the rockets is about \$22 per rocket.

According to Army officials the Army's inventory contains enough screened rockets to meet 100 percent of its war reserve requirement because that requirement is currently about half of what it was in 1994. Army personnel claimed the unscreened rockets pose little risk given that the probability of an EMB in one of these rockets is about one in 57,000—which represents the actual rate of EMBs that occurred during the fiscal year 1992-95 period. In addition, Army aviators with whom we spoke expressed confidence in the Hydra 70 rocket and said they would not hesitate to fire those rockets during combat.

#### Hydra 70 Rocket Performance since Actions to Eliminate Causes of Early Motor Blows

Between January 1995 and March 1999, the Army reported one EMB. An investigation of this incident determined that a pallet of Hydra 70 rockets had been dropped and that the rocket involved in the EMB could have come from that pallet. The Special Operations Forces, Air Force, Navy, and Marine Corps reported no EMBs during this same period.

Officials of the Hydra 70 Program Management Office estimate that the Army/Special Operations Forces fire approximately 216,000 Hydra 70 training rockets per year, the Air Force estimates that it fires between 30,000 and 35,000 annually, and the Navy and Marine Corps estimate they fire a total of about 22,000 annually. Hydra 70 program officials stated that the probability of an EMB for the screened and newly manufactured rockets now falls within the standard of one in a million, which is where it fell prior to the series of EMBs that occurred in the fiscal year 1992 to 1995 period.

#### Agency Comments

In oral comments on a draft of this report DOD fully concurred with its contents. DOD also provided technical comments, which we incorporated as appropriate.

#### Scope and Methodology

To obtain information on the causes of the EMBs, the actions taken to address those causes, and the recent EMB record of the Hydra 70 rocket, we conducted work at the Hydra 70 Program Management Office at Rock Island, Illinois; the Radford Army Ammunition Plant at Radford, Virginia; and the Army Safety Center and the Combat Development Center at Ft. Rucker, Alabama. We also obtained data regarding the Hydra 70 from the following entities: Air Force Air Logistics Center, Hill Air Force Base, Utah; Office of the Deputy Chief of Naval Operations (Resources, Warfare Requirements and Assessments) Air Warfare Division; and Headquarters Marine Corps Office of the Deputy Chief of Staff for Aviation, Aviation Weapons Systems

Requirements Branch. Further, if officials with whom we spoke during conduct of the review were aviators we solicited their opinion regarding the Hydra 70 rocket. This work was conducted during the period December 1998 to March 1999 and in accordance with generally accepted government auditing standards.

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We are sending copies of this report to Representative Ike Skelton, Ranking Minority Member, House Committee on Armed Services; the Honorable William Cohen, Secretary of Defense; the Honorable Louis Caldera, Secretary of the Army; the Honorable Richard Danzig, Secretary of the Navy; the Commandant of the Marine Corps, General Charles C. Krulak; and the Honorable F. W. Peters, Acting Secretary of the Air Force. Copies will also be made available to others upon request.

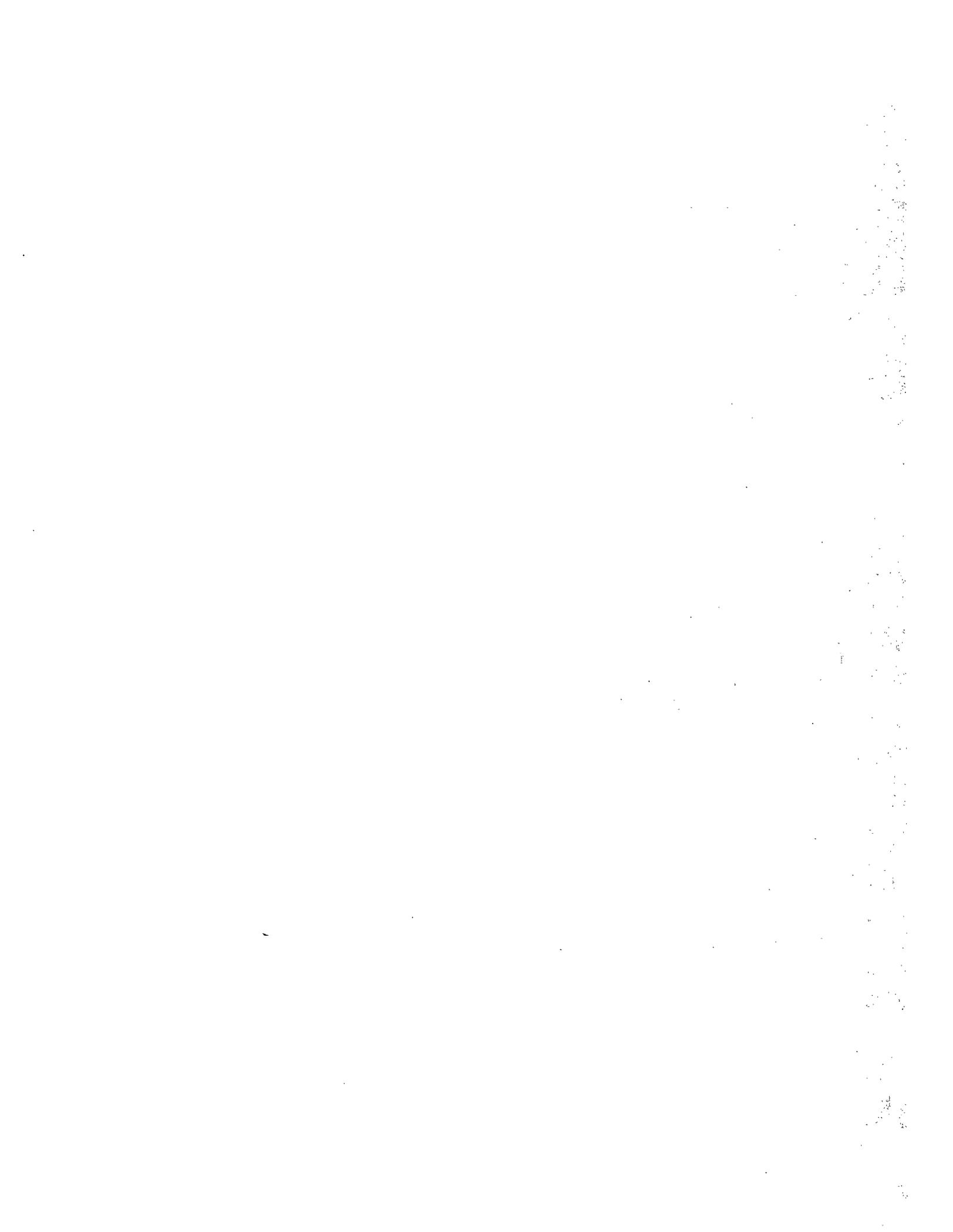
Major contributors to this report are Carol R. Schuster; Reginald L. Furr, Jr.; and Janet M. Keller. If you have any questions on this report, please call me at (202) 512-5140 or my Assistant Director, Reginald L. Furr, Jr., at (202) 512-5426. We appreciate the opportunity to provide you assistance.

Sincerely yours,



Mark E. Gebicke  
Director, Military Operations and  
Capabilities Issues

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