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ICBM MODERNIZATION

Status of the Peacekeeper Rail Garrison Missile System

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The Honorable Robert C. Byrd
Chairman, Committee on Appropriations
United States Senate

The Honorable Sam Nunn
Chairman, Committee on Armed Services
United States Senate

The Honorable Jamie L. Whitten
Chairman, Committee on Appropriations
House of Representatives

The Honorable Les Aspin
Chairman, Committee on Armed Services
House of Representatives

Intercontinental Ballistic Missile (ICBM) modernization continues to be a controversial topic after several years of debate. Because of the high level of congressional interest in the Peacekeeper Rail Garrison basing concept, we have reviewed the progress being made in developing that concept as part of our periodic reviews of the Air Force's ICBM modernization efforts.

Background

The Peacekeeper Rail Garrison concept emerged during 1988 as the Department of Defense's (DOD) highest priority basing mode for ICBMs. Under the concept, a force of 50 missiles will be placed on 25 trains, each carrying two Peacekeeper missiles. The trains will be parked inside train alert shelters in secure garrisons at Air Force bases throughout the continental United States. The missiles will be kept on the trains in continuous strategic alert. In the event of national need, the missiles will move onto the nation's railroad network. If necessary, the missiles can be promptly launched from within the train alert shelters.

The Rail Garrison basing mode will use the Peacekeeper missile with no changes except for software. The missiles would be launched in the same manner Peacekeeper missiles are launched from a silo.

The Congress has made it clear that its authorization of research and development funds does not constitute a commitment to procure and deploy Peacekeeper missiles in a Rail Garrison basing mode.

Acquisition Schedule Is Optimistic

On May 13, 1988, the Secretary of Defense approved the advancement of the Peacekeeper Rail Garrison Program into full-scale development. An initial operational capability (IOC) date of December 1991 was directed by the President. IOC is defined as one train on alert with two missiles plus one train for use in training.

Developing the system by the IOC date requires an ambitious schedule, and all costs, testing, and delivery schedules have been developed to meet this date. Any trade-offs necessary in the future will be made with the primary objective of maintaining the IOC date without degrading mission objectives. To meet this objective, the program office has developed an acquisition schedule with concurrent development and production activities.

The program acquisition schedule is optimistic. The acquisition strategy provides for the start of production 2 years before development contracts are complete—train car development contracts extend into mid-1992, even though a production decision is scheduled for early 1990. This overlap between development and production is referred to as concurrency. Unless concurrency is well planned and controlled, it can cause cost, schedule, and performance problems, as demonstrated in other Air Force acquisition programs.

Program officials agree that concurrency exists, but they believe that Rail Garrison's low technical risk combined with the planned sequential testing and evaluation program represents a reasonable risk in achieving the IOC date.

The initial decision to begin production of Rail Garrison basing hardware is scheduled for March 1990. The program office expects that the results of developmental testing of preliminary designs of individual subsystems will provide adequate information to support that decision. However, by March 1990 only about 2 years of the 4-year test program planned to begin after the start of full-scale development will have been completed. Most systems integration testing, all basing verification missile flight tests, and most of the operational test and evaluation effort will remain to be done.

Cost Estimates

The Air Force estimates Rail Garrison basing program acquisition costs to be about $7.4 billion in then-year dollars. This estimate includes costs to develop and procure train cars and other basing hardware, facility construction, land acquisition, and five basing verification flight test

missiles. It does not include costs associated with developing and acquiring Peacekeeper missiles. All missile costs are included in the original plan to deploy 100 Peacekeeper missiles in Minuteman silos. The Rail Garrison concept has many characteristics that distinguish it from the silo-based program. These differences could require as many as 108 additional Peacekeeper missiles for testing to provide confidence that the rail-based system is as capable as the silo-based system. DOD currently has 17 test missiles (5 for basing verification flight tests and 12 for operational test and evaluation) programmed for Rail Garrison.

In addition to the need to determine the number of operational test and evaluation missiles, the final cost of deploying 100 Peacekeeper missiles—50 in silos and 50 in Rail Garrison—is dependent on several factors: (1) the effect of funding restrictions imposed by the Congress in fiscal year 1989, which could stretch out the program and delay IOC, (2) the congressional funding actions related to annual procurement of Peacekeeper missiles as they affect economical production rates and operational deployment milestones, and (3) the impact of the planned concurrency between development and production of basing system components.

Evaluation of Technical Performance Awaits Testing

The Rail Garrison basing program is in the early stages of its full-scale development phase, and it is too early for any assessment of its technical performance. Certain unique characteristics, such as the capability to restore missile accuracy in a specified time frame and to launch from the missile launch car, remain to be fully evaluated and demonstrated before the effectiveness of the operational concept can be confirmed.

Site Selection Will Determine Land Acquisition Requirements

Peacekeeper missile trains will be deployed initially at F. E. Warren Air Force Base, Wyoming, and at up to 10 other candidate Air Force installations. Depending on the siting alternatives selected, the Air Force may need to acquire 31 to 639 acres of land adjacent to 7 installations for Rail Garrison facilities or relocate existing base facilities to accommodate Rail Garrison facilities. For three of the siting alternatives under consideration, almost all the garrison facilities will be located on land to be acquired off base.

Agency Comments

DOD reviewed a draft of this report and concurred with GAO's findings (see app. III). DOD stated that it did not believe the characteristics of the silo and rail launches would be sufficiently different to require a large

separate test program for the rail mode. DOD believes that the 17 test missiles programmed for Rail Garrison will be sufficient.

We performed our work at the Ballistic Missile Office, Norton Air Force Base, California; the Office of the Secretary of Defense, Air Force Headquarters, the Federal Railroad Administration, the Association of American Railroads, Washington, D.C.; Strategic Air Command, Offutt Air Force Base, Nebraska; Boeing Aerospace Company, Seattle, Washington; and several commercial railroad companies. We conducted our review from September 1987 to October 1988 in accordance with generally accepted government auditing standards.

This report was prepared under the direction of Harry R. Finley, Senior Associate Director. Other major contributors are listed in appendix IV. Copies of our report are being provided to appropriate congressional committees; the Secretaries of Defense and the Air Force; the Director, Office of Management and Budget; and other interested parties.

Frank C. Conahan
Assistant Comptroller General

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Abbreviations

DOD	Department of Defense
GAO	General Accounting Office
ICBM	Intercontinental Ballistic Missile
IOC	initial operational capability
OT&E	operational test and evaluation
SAC	Strategic Air Command

Peacekeeper Rail Garrison Basing Program Status and Issues

Costs

In January 1988 the program office estimated the Rail Garrison basing program cost to be about $5.2 billion in 1982 dollars (referred to as base-year dollars), or about $7.4 billion adjusted for inflation (referred to as then-year dollars). This estimate includes costs to develop and procure train cars and other basing hardware, facility construction, land acquisition, and five basing verification flight test missiles. Table I.1 shows the program office's acquisition cost estimate for the basing program.

Table I.1: Estimated Rail Garrison Basing Program Acquisition Costs

Dollars in billions

Cost category	Base-year dollars	Then-year dollars
Research and development	$2.2	$2.9
Procurement	2.3	3.6
Construction	.7	.9
Total	**$5.2**	**$7.4**

Rail Garrison basing program acquisition cost estimate is not directly comparable to acquisition cost estimates for the Peacekeeper in Minuteman Silo program or the Small Intercontinental Ballistic Missile (ICBM) program. The estimate is for the new basing mode and five basing verification flight test missiles. It does not include procurement costs for the 50 deployment missiles or missiles required for operational test and evaluation (OT&E). All such missile costs are included in the Air Force's plan to deploy Peacekeeper missiles in Minuteman silos and are reported in that program's Selected Acquisition Report. Table I.2 shows the number of missiles planned for procurment under the Peacekeeper in Minuteman silo program.

Table I.2: Missiles Planned for Procurement Under the Peacekeeper in Minuteman Silo Program

Description	Number
Missiles for development, test, and evaluation	20
Missiles for silo deployment (currently capped at 50 missiles by the Congress)	100
Missiles for OT&E (based on Joint Chiefs of Staff guidance)	108
Missiles for aging and surveillance testing	15
Missiles for Rail Garrison OT&E (added in fiscal year 1988)	12[a]
Total	**255**

[a]The Rail Garrison basing program includes five basing verification flight test missiles.

As indicated above, the Air Force is currently planning to procure 12 OT&E missiles to support the Rail Garrison basing program. However, if the Rail Garrison mode is approved by the Congress, the actual number

required for OT&E could range from 0 to 108 depending upon OT&E results and decisions on the number of missiles that may eventually be deployed in the Rail Garrison mode. The following shows the different number of missiles that may be needed.

- According to preliminary Strategic Air Command (SAC) calculations, 24 missiles would be needed for the first 3 years of SAC's Rail Garrison OT&E program—12 more missiles than the Air Force is planning to procure. SAC calculated the number of needed OT&E missiles by applying the same methodology used in determining the number of missiles needed for the Peacekeeper in Minuteman Silo OT&E program, which complies with guidelines provided by the Joint Chiefs of Staff.
- SAC used the same methodology cited above to calculate that an additional 84 OT&E missiles would be needed for a follow-on 12-year test phase if the first 3 years of testing shows differences in Peacekeeper performance when launched from a rail launch car versus a silo.
- Current costs are based on deploying 50 missiles in silos and 50 in the Rail Garrison mode. If the Air Force decides to deploy all 100 Peacekeeper missiles in Rail Garrison basing by transferring 50 missiles from silo basing, as suggested by the Secretary of Defense, then the 12 OT&E missiles may not be necessary. According to an Air Force official, under this plan the 108 missiles planned to be procured for the Peacekeeper in Minuteman Silo OT&E program could be used to support the Rail Garrison test program. Under this scenario, however, there would be additional costs associated with deploying 25 additional trains.

Program officials stated that it is up to the Office of the Secretary of Defense to choose the desired OT&E scenario and the corresponding number of test missiles to be procured.

In commenting on a draft of this report, the Department of Defense (DOD) stated that it did not believe that the characteristics of the Rail Garrison program would be sufficiently different from the silo-based program to require a large, separate test program. DOD believes that the 5 development and 12 operational test missiles programmed for Rail Garrison will be sufficient.

Schedule

In late 1986 the Secretary of Defense recommended and the President directed the development of the Rail Garrison basing concept for Peacekeeper deployment with an initial operational capability (IOC) date of December 1991. (IOC is defined as deployment of one operational train with two missiles and one training train.) According to the program

office, achieving the December 1991 IOC date required an ambitious schedule, with 5 years to design, develop, and test the basing system; begin basing system procurement; begin land acquisition and facility construction; and perform all the other activities necessary to support deployment of Peacekeeper missiles on trains. To meet this challenge, the program office has developed an acquisition schedule containing concurrent development and production activities.

In May 1988 the Secretary of Defense recommended the initiation of full-scale development for the Peacekeeper Rail Garrison basing program. According to the program office acquisition plan, the IOC is the primary driver of the overall Rail Garrison program schedule. Cost, performance requirements, and contract delivery schedules have been developed to meet this date, and any trade-offs necessary in the future will be made with the primary objective of maintaining it without degrading mission objectives. Table I.3 shows selected approved program milestones as of May 1988.

Table I.3: Approved Program Milestones

Milestone	Date
Start of full-scale development	May 1988
System design reviews	September 1988
Preliminary design reviews	February - May 1989
Critical design reviews	December 1989 - March 1990
Initial production decision	March 1990
Basing verification missile tests	June 1991 - May 1992
Initial operational capability	December 1991
Full-rate production decision	March 1992
Full operational capability	December 1993

In our view, the program acquisition schedule for the basing system is optimistic for the following reasons.

- The contractually required functional configuration audit intended to validate that the development of a weapon system component has been completed satisfactorily is scheduled to start in January 1991, about 9 months after the initial production decision, and continues through September 1991, about 3 months before the IOC date.
- The initial production decision for the basing system is scheduled some 15 to 19 months before the first of five scheduled basing verification flight tests, which are to demonstrate the compatibility of Rail Garrison basing and Peacekeeper missile hardware and software.

- The initial production decision is currently scheduled for March 1990. On the basis of a program office plan, at least 30 of the 50 operational missile launch cars could be put on contract and 13 cars delivered before the full rate production decision in March 1992.

It should be noted, however, that in authorizing full-scale development in May 1988, the Secretary of Defense stated that the number of trains to be acquired on the initial production contract had not been decided. He stated that a determination on production rates would be an issue for the Defense Acquisition Board when it meets to authorize the initial production.

Concurrency

The Rail Garrison acquisition strategy provides for the start of production 2 years before the completion of development contracts—the train car development contracts extend into mid-1992, even though a production decision is scheduled for early 1990. This overlap between development and production is referred to as concurrency. Concurrency can be an effective technique to expedite the development and production of weapon systems, provided the practice is well planned and controlled. Although program officials acknowledge that concurrency exists, they believe that Rail Garrison's low technical risk combined with the planned sequential testing and evaluation program represents a reasonable risk approach to achieving the IOC date. Our past reviews, however, have regularly identified concurrency as one cause of cost, schedule, and performance problems in weapon system acquisition programs. Therefore, we believe concurrent Rail Garrison basing development and procurement activities will warrant continued management attention.

Rail Garrison Testing Overlaps Production and Deployment Activities

According to the program office, the results of developmental testing of preliminary designs of individual subsystems will provide adequate information to support an initial production decision scheduled for March 1990. However, at that time only about 2 years of the 4-year test program planned at the beginning of full-scale development will be completed, and most systems integration testing, all weapon systems testing including 5 basing verification missile flight tests, and most of the operational test and evaluation effort will remain to be done. At the outset of full-scale development, the Peacekeeper Rail Garrison test and evaluation effort is a combined development test and evaluation and operational test and evaluation program. The emphasis at the beginning of full-scale development will be on development testing, with a gradual

shift in the emphasis to operational testing after the production decision. The combined test program involves three phases: development testing, integration testing (development integration and system integration testing), and weapon system testing. Most of the operational test and evaluation testing are planned to be conducted during the system integration and weapon system testing phases, during the calendar year period 1990 to 1992.

Development tests and development integration tests will be conducted on preliminary designs of mechanical and electrical hardware subsystems to provide data for Critical Design Reviews and to support the initial production decision planned for March 1990. In general, Critical Design Reviews are formal technical reviews of components or subsystems to determine whether their designs meet specifications before the commitment of those designs to production. The Ballistic Missile Office plans to conduct these reviews from December 1989 through March 1990.

Systems integration testing is scheduled to begin in January 1990. This testing is designed to (1) integrate the electrical, mechanical and software systems in the respective locomotive, missile launch car, launch control car, maintenance car, and security car and (2) evaluate the performance of entire systems. The testing is to continue until July 1992, overlapping operational hardware production.

Weapon system testing to demonstrate and confirm system performance in specified operating environments is to begin in January 1991. This final test phase includes both ground and flight testing to demonstrate and confirm the compatibility of the complete weapon system hardware and software. The first of five basing verification missile flight tests is scheduled for the third quarter of calendar year 1991, about 15 to 19 months after the scheduled initial production decision. The final three flight tests are scheduled after the IOC date of December 1991, and the final flight is scheduled for no later than June 1992.

The program office does not consider the overlap among testing, production, and deployment to be an issue for the Rail Garrison program because it is not developing and testing new technology; rather, it is conducting engineering efforts to integrate proven missile systems into the existing rail industry. Although a considerable amount of testing will be done before the production decision, most of this testing is to be conducted on preliminary designs of individual subsystems and is intended

to evaluate the performance of individual subsystems rather than demonstrate weapon system operational effectiveness.[1]

Funding

The Congress approved $440 million for the Rail Garrison basing program—$90 million and $350 million in fiscal years 1987 and 1988, respectively, for research and development. The Congress stated that authorization of Rail Garrison research and development funds for fiscal year 1988 did not constitute a commitment or express an intent by the Congress to provide funds to deploy any Peacekeeper missiles in a Rail Garrison basing mode. The Congress appropriated $600 million in fiscal year 1989 for research and development. However, only $250 million can be obligated before February 15, 1989. Furthermore, the Congress requested the President to submit a report to the Committees on Armed Services and Appropriations between January 21, 1989, and February 15, 1989, on how funds for ICBM modernization would be obligated for the remaining amount.

Availability of Procurement Funds

The availability of sufficient procurement funds to support attainment of initial and full operational capability dates, as currently scheduled, is uncertain because of the following.

- DOD stated that all 12 Peacekeeper missiles, for which fiscal years 1989 procurement funds were being requested, would be used for Peacekeeper OT&E and aging and surveillance tests. None was planned for use on the Rail Garrison program. The unavailability of fiscal year 1989 missile procurement funds reduces the time available to procure missiles for Rail Garrison deployment before the IOC date from about 39 to 27 months, assuming fiscal year 1990 missile procurement funds are appropriated for Rail Garrison. Since it takes about 32 months to acquire parts and manufacture a Peacekeeper guidance and control system, achieving the IOC date with missile systems procured specifically for Rail Garrison deployment will be a challenging task.
- In 1986, 1987, and 1988, the Congress authorized the procurement of 12 Peacekeeper missiles each year for silo deployment and OT&E—36 missiles in total. During the 3-year period, DOD had requested funds for 90 missiles. In keeping with this pattern, DOD reduced its fiscal year 1989 missile procurement request from 21 to 12. Table I.4 shows current missile procurements, deliveries, and test plans.

[1]Operational effectiveness is defined as the ability of a system to accomplish its mission when placed in use in the planned operational environment.

Table I.4: Missile Procurements, Deliveries, and Scheduled Tests

Fiscal year	Actual/planned procurements	Actual/planned deliveries	Scheduled OT&E Tests
1986 and before	54	6	
1987	12	24	
1988[a]	12	17	
1989	12	12	3
1990	21	12	8
1991	21	12	8
1992	21	17	8
1993	21	Unknown	7
Subtotal	**174**	**100**	**34**
Beyond 1993	61	135	74
Total	**235**	**235**	**108**

[a]Missile procurements and deliveries through fiscal year 1988 are actual.

As indicated in table I.4, DOD plans to request 21 missiles a year in future years. DOD will need 134 missiles by the end of December 1993: 50 missiles for the silo program, 34 missiles for OT&E, and 50 missiles to achieve full operational capability for Rail Garrison. To ensure that the 134 missiles are delivered by December 1993, DOD will have to procure more than the currently planned 21 missiles in fiscal year 1990 and 1991 or use some of the Peacekeeper OT&E missiles for Rail Garrison operations.

All missiles procured through fiscal year 1989 have been for the Peacekeeper in Minuteman Silo Program (50 missiles for deployment and 40 missiles for operational test and evaluation). Since it takes about 3 years to manufacture a Peacekeeper missile, any missile procured after fiscal year 1989 would not be available in time to support Rail Garrison initial deployment planned for December 1991. Therefore, some missiles purchased for the Peacekeeper in Minuteman Silo program will have to be used for Rail Garrison. Program officials stated that a sufficient number of Peacekeeper missiles are being acquired to support deployment if congressional approval is provided to use some OT&E missiles for Rail Garrison operations.

Performance

Although Rail Garrison involves requirements uncommon to silo-based ICBM systems, the Air Force believes that the Rail Garrison option offers a low-risk program that is principally an engineering effort taking advantage of existing equipment and technology, existing rail network infrastructure and existing SAC bases and ICBM infrastructure, such as

nuclear weapons storage areas and strategic command, control, and communications systems.

The Rail Garrison basing program entered the full-scale development phase in May 1988, and any conclusive assessment of its technical performance must await the results of planned testing. In particular, certain unique operational effectiveness characteristics associated with mobility on the rail network, such as the capability to restore missile accuracy in a specified time frame and to launch from the missile launch car, must be fully evaluated and demonstrated before the effectiveness of the operational concept can be confirmed. In addition, the viability of the Rail Garrison concept is predicated upon sufficient rail availability and establishing acceptable working relationships with the railroads.

Missile Accuracy Restoration

If Rail Garrison is to place time-urgent, time-sensitive hard targets at risk the Air Force must develop the means to restore the guidance and control system accuracy within specified time frames after the train has been moved. On the basis of studies and analyses and an initial rail test, the Air Force is confident that accuracy can be restored within specified time frames. This test involved moving the guidance and control system's inertial measurement unit in a van on a rail car between El Paso, Texas, and Santa Ana, California, to characterize navigation and accuracy updating associated with rail mobility. The test indicated that guidance and control instruments remained stable, but that navigation aids may be required for launch from non-presurveyed benchmark locations.

The program office plans to continue to define the effects of movement on system accuracy and evaluate the means to restore accuracy from anywhere on the rail network through a series of tests, including the following.

- Rail van tests on commercial rail networks scheduled for late 1988, mid-1989, and late 1990 will be performed to further define navigation and accuracy updating associated with rail mobility.
- Vibration tests planned for late 1988 are being performed to evaluate alignment recovery models for vibration tolerances.
- Land navigation sled tests scheduled for early 1989, late 1989, and late 1990 will be performed to evaluate alternative methods for velocity, heading, altitude, and position determination.

Missile Launch From a Rail Car

In analyzing and evaluating the capability to launch a missile from a rail car (as opposed to a silo) and resume mobile operations following launch, the program office has many factors to consider such as the train's ability to withstand the effects of missile launch and subsequent first-stage ignition and the launch effects on commercial railroad trackbeds. The program office believes that the 17 Peacekeeper flight tests have provided confidence that the pressures, shock, heat, and noise of first-stage ignition will not create difficulties. In addition, simulated effects of launch ejection reaction loads on a developmental model of the car, track, and roadbed led the program office to conclude that these elements can sustain launch loads.

These tests were performed in March and July 1988. Information from these tests will also be used to define launch point conditions and to develop the test objectives for a canister assembly launch test program. Additional testing is planned to further evaluate, demonstrate, and confirm the capability to launch from a rail car either from the train alert shelter or while dispersed on the rail network. These tests include the following.

- A canister assembly launch test program to be conducted between mid-1989 and early 1990 will continue the development of the launch conditions, define the launch constraints, and refine the test objectives for the final phase of launch capability development during the flight test program.
- In April and May 1991 the capability of the missile launch car to perform canister erection through the train alert shelter roof opening will be tested. The capability to actually launch from a train alert shelter will be part of the basing verification flight test program unless other test results prove this launch is not required.
- An evaluation of the capability of the missile launch car to reconfigure for mobility will be done as part of basing verification flight test program.

Railroad Interface

To ensure the mobility necessary for survivability, the Air Force must be confident that enough track to meet the size requirements of the missile train is available. Survivability also depends upon the ability of the Peacekeeper train to operate safely on the available rail network in conjunction with commercial rail traffic.

To facilitate the planning and evaluation of the Rail Garrison basing concept, the Air Force entered into an interagency agreement with the

Federal Railroad Administration in August 1987 to have that agency provide technical assistance and counsel. The Federal Railroad Administration identified the Association of American Railroads, through its member operating rail companies, as the organization best qualified to evaluate railroad network restrictions and requirements that might affect the development of the Rail Garrison basing concept. Consequently, the Federal Railroad Administration contracted with the Association to provide technical assistance in vehicle dynamics, track structure, railroad operations, and an assessment of the available rail network.

Rail Availability for Peacekeeper Operations

Based on the size and weight specifications for Rail Garrison, the Federal Railroad Administration and the Association of American Railroads estimate that at least 120,000 miles of track is available for Rail Garrison deployment. This estimate represents the preliminary results of assessments being done by the railroads under contract to the Association of American Railroads. Further track assessments and analyses are scheduled during full-scale development to determine more precisely what track is available. Table I.5 shows train car size dimensions that were used in calculating the availability of suitable track.

Table I.5: Peacekeeper Rail Garrison Train Car Dimensions

Train cars	Weight	Length	Height	Width
Security/personnel car	300,000 lbs	90'	15'9"	9'5"
Launch control car	300,000 lbs	90'	15'9"	9'5"
Maintenance car	200,000 lbs	90'	15'9"	9'5"
Missile launch car	580,800 lbs	90'	15'9"	9'5"

Program officials stated that the rail car dimensions listed in table I.5 meet design standards established by the Association of American Railroads, and they are confident that rail cars of these dimensions can be developed and manufactured. The Federal Railroad Administration, the Association of American Railroads, and several railroad companies advised us that they believe the Air Force will have no problems in developing Peacekeeper rail cars that meet railroad car dimension standards. Nevertheless, as the Rail Garrison concept matures, the potential for growth does exist, and increases in rail car dimensions could reduce the amount of suitable track mileage available for deployment. In this regard, we noted the following.

- The physical characteristics of the rail system constrain missile launch car size, e.g., tunnel and bridge clearances, the distance between parallel tracks, and the degree of track curvature.
- Current Air Force specifications require the missile launch car not to exceed 550,000 pounds, including the weight of the missile. Program officials do not expect the launch car weight to exceed specifications. However, past experiences in developing mobile launch vehicles for the Peacekeeper missile and Small ICBM suggest the potential for missile launch car weight growth; for example, the initial design concept for Small ICBM's hard mobile launcher weighed about 120,000 pounds, and, as the design matured, the weight of the launcher grew to between 180,000 and 195,000 pounds. Also, the original design concept of the missile launch car has changed to allow greater weight. The initial concept restricted missile launch car weight to 526,000 pounds, but, by increasing the diameter of the wheels and making other changes to the chassis, a total weight of 630,000 pounds is now allowable.

Joint Operations With Commercial Railroads

The ultimate goal for interface between Rail Garrison and the commercial rail network is a system that will operate under formal agreements with railroad companies in compliance with railroad operational policies and practices and within government regulations already imposed on the railroad industry. Based on preliminary talks with the railroad companies, the Ballistic Missile Office anticipates no problems in defining agreements for track usage. Also, during our discussions with the railroad companies, they indicated that they did not expect problems in negotiating Rail Garrison operations.

An interoperability working group composed of representatives from the Federal Railroad Administration, the Association of American Railroads, Air Force Systems Command, SAC, the Ballistic Missile Office, and Air Force Headquarters has been formed to ensure that (1) smooth system interface takes place with the nation's railroads, (2) the railroad interoperability studies and analyses address the concerns and meet the requirements of all parties involved in eventual system operation, (3) a forum exists for the exchange of ideas between the Air Force and commercial railroad companies, which fosters cooperative efforts, and (4) these ideas are integrated and coordinated with minimum duplication of effort. The Ballistic Missile Office expects to be finalizing formal agreements with the railroad companies between mid-1990 and mid-1991.

Selection of Deployment Areas

F. E. Warren Air Force Base, Wyoming, is the designated main operating base and the first garrison deployment installation for the Peacekeeper Rail Garrison system. The system is planned to be deployed at up to 10 other candidate Air Force installations. The following Air Force installations, listed in alphabetical order, were identified by the Air Force as having the greatest potential to support the Peacekeeper Rail Garrison system.

Table I.6: Potential Peacekeeper Rail Garrison Installations

Installation	State
Barksdale Air Force Base	Louisiana
Eaker Air Force Base	Arkansas
Dyess Air Force Base	Texas
Fairchild Air Force Base	Washington
Grand Forks Air Force Base	North Dakota
Little Rock Air Force Base	Arkansas
Malmstrom Air Force Base	Montana
Minot Air Force Base	North Dakota
Whiteman Air Force Base	Missouri
Wurtsmith Air Force Base	Michigan

The Air Force is preparing an environmental impact statement to aid in the final selection of deployment installations, the siting of facilities, and the development of appropriate mitigation measures. This process formally started in February 1988 with a draft environmental impact statement being issued in June 1988 for public comment and a final statement planned to be filed in December 1988. In early 1989, after the final statement is filed, deployment installations for the Peacekeeper Rail Garrison system, in addition to F. E. Warren Air Force Base, will be selected. In March 1989 the Air Force plans to begin land acquisition for the second, third, and fourth deployment locations. Currently, the Air Force projects that the missile assembly building and the garrison at F.E. Warren Air Force Base and at bases 2, 3, and 4 will be funded to begin construction in fiscal year 1990. The Air Force is discussing several issues and related mitigating issues in the draft environmental impact statement. Most candidate installations have at least one issue of significance that requires mitigation. The following are examples of these issues.

- While the Air Force would have preferred bases where garrison facilities and explosive safety zones could be contained within base boundaries, that was not possible in all instances. Land may need to be acquired

adjacent to seven installations (Eaker, Fairchild, F.E. Warren, Grand Forks, Malmstrom, Minot, and Whiteman Air Force Bases) for Rail Garrison facilities or to relocate existing base facilities to accommodate Rail Garrison facilities. The amount of land needed for Rail Garrison or relocated facilities ranges from 31 acres at Malmstrom Air Force Base to 639 acres at F.E. Warren Air Force Base (south site option). At three installations (Eaker/off-base option, Minot, and F.E. Warren/south site option), almost all the garrison facilities would be sited on land to be acquired off base. The acquisition of off-base land for garrison facilities at F.E. Warren and Eaker Air Force Bases would be for alternative siting plans that have been developed to mitigate other environmental issues.

- A special area of concern is a 70-acre major archaeological village site at Eaker Air Force Base. This site contains Native American artifacts and remains and is being studied for eligibility for inclusion on the National Register of Historic Places. An alternative site is being considered that would place the entire garrison off base and require the acquisition of 371 acres of agricultural land. There have also been some archaeological finds at this site, but not to the same degree as at the other site.
- At Barksdale Air Force Base, long-term impacts on biological resources would be high, according to the Air Force, because the program would affect large areas, cause disturbances in surrounding wetland habitats, affect sensitive wildlife populations, and result in the degradation of local and regional biological communities. The Air Force stated that similar conditions exist at Fairchild, Whiteman, and Wurtsmith Air Force Bases; however, the long-term impacts would be moderate.

The final acceptability of the Air Force's siting proposals and related mitigating measures will not be known until after the public has an opportunity to comment on the draft environmental impact statement.

Peacekeeper Rail Garrison Operational Concept and Weapon System Description

Operational Concept

The principal mission of the Peacekeeper Rail Garrison weapon system is to deter nuclear and conventional attacks against the United States, its allies, and any nation whose security is vital to the U.S.' interests. The weapon system is intended to combine the capabilities of the Peacekeeper missile, such as payload, range, and accuracy, with the survivability and flexibility inherent in the Rail Garrison basing approach. The Air Force believes that the survivability associated with the dispersal of trains over a large geographical area will strongly contribute to Soviet uncertainty in achieving their war aims without receiving unacceptable damage in return.

The Peacekeeper Rail Garrison weapon system consists of Peacekeeper missiles deployed in a Rail Garrison basing mode, together with operational and maintenance support equipment and facilities. A force of 50 missiles will be placed on 25 trains, each carrying 2 Peacekeeper missiles. The trains will be parked inside train alert shelters in secure garrisons at the main operating base at F.E. Warren Air Force Base, Wyoming, and at existing Air Force bases throughout the continental United States, with up to 4 trains at each garrison. About 2,600 SAC personnel will be needed to operate and maintain the system.

Within the garrisons, the trains and missiles will be protected by double fences, perimeter detection systems, and entry control procedures. The missiles will be kept on the trains in continuous strategic alert, and, if necessary, the missiles can be promptly launched from within the train alert shelters.

In the event of national need, the Peacekeeper missiles will move onto the nation's railroad network. One potential Air Force operational scenario calls for the first train to be deployed from each garrison within 15 minutes after receiving and authenticating a dispersal directive. Remaining trains would be deployed at 2-hour intervals and dispersed within 12 hours. Each train would be staffed with a 29-person crew consisting of 1 train commander, 3 train crew members, 4 combat crew personnel, 15 security personnel, and 6 maintenance personnel. According to the program office, Peacekeeper trains from 7 garrisons can be dispersed within 24 hours to any point in the continental United States rail network having suitable track. Once dispersed, the trains will be self-sufficient and can remain operational indefinitely with resupply and maintenance. Outside the garrisons, the trains will use their own security systems and security personnel to prevent unauthorized access to the missile and its nuclear warheads. Security elements on the train consist

of entry control, various electronic sensors, and devices to delay or deny access to the nuclear warhead.

Missiles can be launched from the dispersed rail cars when an execution directive is received and authenticated and all guidance updates have been completed. The rail cars will be stopped and the missile's targets updated while the missile launch cars are stabilized. Then, the missile guidance system will perform the necessary alignment and estimate initial conditions before the system is readied for missile launch. Once a missile is launched, the train can be prepared to resume movement.

Missile Description

The Rail Garrison basing mode will use the Peacekeeper missile with no changes except for software. The Peacekeeper is a four-stage ICBM designed to deliver ten Mark 21 reentry vehicles to independent targets. The missile is approximately 71 feet long and 92 inches in diameter and weighs 195,000 pounds. The first three stages are fueled by solid propellants; the fourth stage uses liquid propellant. The missile's guidance and control system keeps the missile on the proper flight path and provides target accuracy.

Garrison Description

Garrison designs may vary slightly to accommodate base-specific requirements and constraints, but the basic complement of facilities will be standard throughout the system. Each garrison will have up to four train alert shelters that consist of structures about 1,200 feet long and 30 feet high. Each garrison will also have maintenance facilities to provide the capability to remove or replace the missile guidance and control set and the reentry system and to provide other missile and train maintenance. Design of the operational garrison is part of a $236 million contract awarded to the Boeing Aerospace Company in September 1987, which also provides for the design, development, and fabrication of unique transportation and handling equipment, test facilities, test support equipment, maintenance car, and modification to the train locomotive.

Train Description

Each train will consist of two locomotives, two missile launch cars, two security cars, one launch control car, and one maintenance car. The train's external appearance will resemble commercial freight rail equipment as much as possible.

The locomotive and the chassis for each train car will be commercially available equipment, modified as necessary to support the Rail Garrison design.

The Peacekeeper missile, the canister, and the operational support equipment will be housed in the missile launch car. A launch eject gas generator providing pressurized gas below the first stage will eject the missile from the canister, and the first stage will ignite after ejection. This manner of launch is referred to as "cold launch" and is the way in which Peacekeeper missiles are launched from a silo. In May 1988 the program office awarded a $167 million contract to Westinghouse Electric Corporation for development of the missile launch car.

The launch control car will contain all the functional capabilities of a Peacekeeper in Minuteman silo stationary launch control center such as a launch control system and a communication system. Communications between the launch control car and higher authority will be available, and a full complement of communications links is planned between the system and SAC elements. The launch control system performs critical functions of targeting, launch authorization, and launch, as well as status monitoring. Targeting operations and launch control processing will be essentially identical to Peacekeeper in silos. In May 1988 the program office awarded a $162 million contract to Rockwell International for developing the launch control and security cars, as well as the train security system.

Comments From the Department of Defense

DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING

WASHINGTON, DC 20301-3010

5 [illegible] 1988

Mr. Frank C. Conahan
Assistant Comptroller General
United States General Accounting Office
National Security and International
Affairs Division
Washington, DC 20548

Dear Mr. Conahan:

This is the Department of Defense (DoD) response to the General Accounting Office (GAO) draft report, "ICBM MODERNIZATION: Status of the Peacekeeper Rail Garrison Missile System," dated October 11, 1988 (GAO Code 392364, OSD Case 7795).

The Department has reviewed the report and concurs with the findings. Additional comments on the findings are provided in the enclosure. The Department appreciates the opportunity to comment on this draft report.

Sincerely,

Robert C. Duncan

Enclosure

GAO DRAFT REPORT - DATED OCTOBER 11, 1988
(GAO CODE 392364) OSD CASE 7795

"ICBM MODERNIZATION: STATUS OF THE
PEACEKEEPER RAIL GARRISON MISSILE SYSTEM"

DEPARTMENT OF DEFENSE COMMENTS

* * * * *

FINDINGS

See pp. 1-3, 8.

- FINDING A: The Peacekeeper Rail Garrison Missile System. The GAO reported that the Peacekeeper Rail Garrison Weapon System consists of Peacekeeper missiles deployed in a rail garrison basing mode, together with operational and maintenance support equipment and facilities, including a force of 50 missiles to be placed on 25 trains (each carrying two Peacekeeper missiles). According to the GAO, the Air Force estimated the Rail Garrison Basing Program acquisition to cost about $7.4 billion in then-year dollars. The GAO found that, on May 13, 1988, the Secretary of Defense approved the advancement of the Peacekeeper Program into full-scale development. The GAO concluded that an ambitious schedule will be required to meet the initial operational capability (IOC) December 1991 date. The GAO reported that the Congress approved $440 million for the Rail Garrison Basing Program in FY 1987 and FY 1988 and $837.3 million is being requested for FY 1989. The GAO further reported that, although the Rail Garrison Basing Program involves different requirements from those of silo-based ICBM systems, the Air Force has concluded that the Rail Garrison option offers a low risk program, which is principally an engineering effort, taking advantage of existing equipment and technology. According to the GAO, the Peacekeeper missile trains will be deployed initially at F.E. Warren Air Force Base, Wyoming, and eventually at up to ten other Air Force installations, yet to be selected.

  DoD Response: Concur

See pp. 2-3, 8.

- FINDING B: The Cost of the Peacekeeper Rail Garrison Basing Program. As indicated, the GAO reported that the Air Force estimated that the Rail Garrison Basing Program acquisition will cost about $7.4 billion in then-year dollars, including costs to develop and procure train cars, facility construction, land acquisition and five basing verification flight test missiles. The GAO noted that the estimate does not include costs associated with developing and acquiring Peacekeeper missiles, which were included in the original plan to deploy 100 Peacekeeper missiles in Minuteman silos. The GAO observed that the rail garrison concept has many

characteristics that distinguish it from the silo-based programs. According to the GAO, these differences could require as many as 108 additional Peacekeeper missiles for testing in order to provide confidence that the rail-based system is as capable as the silo-based system. The GAO concluded that, in addition to the need to determine the number of operational test and evaluation missiles, the final cost of deploying 100 Peacekeeper missiles--50 in silos and 50 in rail garrison--is dependent on several factors, as follows:

- the impact of any reduction in the FY 1989 budget request;
- the congressional funding actions related to annual procurement of Peacekeeper missiles, as they affect economical production rates and operational deployment milestones; and
- the impact of the planned concurrency between development and production of basing system components.

DoD Response: Concur. It is the DoD view that the characteristics of the silo and rail launches will not be sufficiently different to require a large, separate test program for the rail mode. It is also the DoD view that the five development and twelve operational test missiles programmed for the rail mode will be sufficient.

See pp. 2, 9-13.

o FINDING C: Peacekeeper Program Acquisition Schedule Is Optimistic. The GAO reported that (as previously noted), on May 13, 1988, the Secretary of Defense approved the advancement of the Peacekeeper Rail Garrison Program into full-scale development. The GAO again observed that developing the system by the initial operational capability (IOC) date will require an ambitious schedule. The GAO observed that all costs, testing, and delivery schedules will need to be developed to meet this date. The GAO concluded that, in order to meet this objective, the program office needs to develop an acquisition schedule with concurrent development and production activities. The GAO reported that, while program officials agree concurrency exists, they maintain that the rail garrison low technical risk, combined with the planned sequential testing and evaluation program, represents a reasonable risk in achieving the December 1991 IOC date. The GAO nevertheless concluded that the program acquisition schedule is optimistic because the acquisition strategy provides for the start of production two years before development contracts are complete. While noting the overlap between development and production (referred to as concurrency) can be an effective technique to expedite fielding weapon systems, the

GAO concluded that, unless concurrency is well planned and controlled, it can cause cost, schedule, and performance problems.

DoD Response: Concur

See pp. 13-14.

- FINDING D: Funding For The Peacekeeper Rail Garrison Basing Program. The GAO reported that the Congress approved $440 million for the Rail Garrison Basing Program in FY 1987 and FY 1988 for research and development; and for FY 1989, about $837.3 million was requested ($792.9 million for research and development and $44.4 million for construction). According to the GAO, the availability of sufficient procurement funds to support the attainment of initial and full operational capability dates, as currently scheduled, is uncertain because the DoD stated that all 12 Peacekeeper missiles, for which FY 1989 procurement funds were being requested, would be used for Peacekeeper operational test and evaluation and for aging and surveillance tests, while none were planned for use in the Rail Garrison Basing Program. Since it takes about 32 months to acquire parts and manufacture a Peacekeeper guidance and control system, the GAO concluded that achieving the IOC date with missile systems procured specifically for rail garrison deployment will be challenging. The GAO also cited another uncertainty--i.e., that in FY 1986, FY 1987, and FY 1988, the Congress authorized the procurement of 12 Peacekeeper missiles each year for silo deployment and OT&E while, at the same time, the DoD requested funds for 90 missiles. The GAO estimated that the DoD will need 134 missiles by the end of December 1993, including 50 missiles for the Rail Garrison Basing Program. The GAO concluded that, to ensure the 134 missiles are delivered by December 1993, the DoD will have to procure more than the currently planned 21 missiles in FY 1990 and FY 1991. The GAO reported, however, that DoD Program Officials were confident that a sufficient number of Peacekeeper missiles are being acquired to support deployment, if Congressional approval is provided to use some OT&E missiles for rail garrison operations.

DoD Response: Concur

See pp. 3, 14-18.

- FINDING E: Evaluation of Technical Performance Awaits Testing. The GAO reported that, although the Rail Garrison Basing Program involves requirements different from the silo-based ICBM systems, the Air Force maintains that the rail garrison option offers a low risk program--i.e., principally an engineering effort taking advantage of existing equipment and technology. The GAO observed that the Rail Garrison Basing Program just entered the full-scale development phase in May 1988; therefore, any conclusive assessment of technical performance must await the results of planned testing. The GAO noted that certain unique operational effectiveness characteristics associated with

mobility on the rail network (such as the capability to restore missile accuracy in a specified time frame and to launch from the missile launch car) must be fully evaluated and demonstrated before the effectiveness of the operational concept can be confirmed. The GAO also observed that the viability of the rail garrison concept is predicated upon sufficient rail availability and establishing acceptable working relationships with the railroads. The GAO concluded that the Rail Garrison Basing Program is still in the early stages of its technical performance.

DoD Response: Concur

See pp. 3, 19-20.

- FINDING F: Site Selection Will Determine Land Acquisition Requirements. The GAO reported that Peacekeeper missile trains will be deployed initially at F.E. Warren Air Force Base, Wyoming, and subsequently at up to ten other candidate Air Force installations. According to the GAO, depending on the siting alternatives selected, the Air Force may need to acquire 32 to 639 acres of land adjacent to seven installations for the rail garrison facilities or relocate existing base facilities to accommodate rail garrison facilities. The GAO found that, for three of the siting alternatives under consideration, almost all the garrison facilities will be located on land to be acquired off base. The GAO observed that the Air Force is preparing an environmental impact statement to aid in the final selection of deployment installations, the siting of facilities, and the development of appropriate mitigation measures. The GAO concluded that the final acceptability of the Air Force siting proposals and related mitigating measures will not be known until after the public has had an opportunity to comment on the draft environmental impact statement.

  DoD Response: Concur

RECOMMENDATIONS

- NONE.

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