BY THE COMPTROLLER GENERAL

Report To The Congress

OF THE UNITED STATES

Evaluation Of The Decision To Begin Production Of The Roland Missile System

The Chairman of the House Special Subcommittee on NATO Standardization, Interoperability and Readiness asked GAO to review the Department of Defense's decision to produce the Roland missile system and related questions.

The decision to begin producing Roland was based on the assumption that the system has sufficiently demonstrated its ability to perform its short-range air defense mission. However, in testing to date it falls short of meeting several important requirements.

Further testing of Roland may show the superiority that the Army claims for it over other systems. At this point this is not readily discernible.

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COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON, D.C. 20548

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To the President of the Senate and the
Speaker of the House of Representatives

This report presents our evaluation of the Department of Defense's decision to begin limited production of the Roland missile and includes information on the current status of the program. Agency officials associated with the program reviewed a draft of this report, and their comments are incorporated as appropriate.

We believe this report will be useful to the Congress in making future decisions regarding the Roland missile program.

We are sending copies of this report to the Director, Office of Management and Budget, and to the Secretary of Defense.

Comptroller General
of the United States

COMPTROLLER GENERAL'S
REPORT TO THE CONGRESS

EVALUATION OF THE DECISION TO BEGIN PRODUCTION OF THE ROLAND MISSILE SYSTEM

D I G E S T

In June 1979, following a 4-1/2 year period to fabricate and test, the Secretary of Defense approved limited production of the Roland missile system.

From discussions between GAO and some of the principals, it is apparent that this decision was reached only after extensive deliberations in the Offices of the Secretary of Defense and the Secretary of the Army.

The decision was consistent with recommendations by senior Army and Defense officials, who rejected the findings in recent Army studies, that other systems were more cost effective and preferable for the air defense role.

Roland is a European-developed missile system for defending critical corps and rear-area targets in clear or adverse weather against low-flying aircraft. The system is estimated to cost over $2.4 billion.

However, Roland has experienced serious technical difficulties in testing. The program's estimated cost has almost doubled since it was selected for acquisition in 1975. (See pp. 6-7.)

Possible alternatives to Roland are improved versions of the existing Hawk and Chaparral systems. Each would require modifications that are within the state-of-the-art development and testing. The modified systems would require development and testing and for this reason their availability to the Army is uncertain. Project representatives for the two systems, however, estimate their availability at approximately the same time as Roland's. (See pp. 10-11 and 15.)

The decision to proceed with Roland was based on an assumption that the system had met most of its operational capability requirements.

In fact, its test performance has been unconvincing in several important respects. Modifications to overcome its deficiencies are being designed but remain to be adequately tested.

Some key components have still to demonstrate their reliability. The system has shown a low probability of performing a 72-hour mission without major maintenance. This contrasts with a specified 90-percent probability requirement. (See pp. 4-5.)

Modifications will also have to be devised to improve Roland's vulnerability to projected countermeasures and to correct other problems. Because testing performed so far has not been rigorous enough to assess its expected threat capability and testing in adverse weather has been limited, the decision to begin production appears premature. (See p. 20.)

Further testing of Roland may show the superiority over other candidates that the Army claims for it. At this point this is not readily discernible.

AGENCY COMMENTS

The Department of Defense generally disagreed with GAO's evaluation. It asserted that Roland's ability is about at the point it was expected to be at this stage of its development. It is confident that modifications in development or under study will correct the problems Roland has experienced in testing. Defense officials believe there are sufficient technical uncertainties and other shortcomings attached to the alternative air defense system candidates to raise doubts about their becoming available as quickly as Roland can be fielded. (See pp. 17-19.)

It is difficult to support or fault the Department of Defense's decision to begin production because to a great extent it was based on judgment. Such matters as the proper confidence level in Roland's ability

to overcome its technical problems, its prospects for achieving the desired reliability, and its capability to meet certain threats, are all arguable.

Contents

ABBREVIATIONS

ASARC	Army System Acquisition Review Council
COEA	cost and operational effectiveness analysis
DSARC	Defense Systems Acquisition Review Council
FLIR	Forward Looking Infrared Radar
GAO	General Accounting Office
NATO	North Atlantic Treaty Organization
POST	Passive Optical Seeker Technique

CHAPTER 1

INTRODUCTION

Roland is a European-developed missile system being acquired by the U.S. Army to strengthen its defenses against low-flying aircraft. The system is required to be capable of defending critical corps and rear-area targets in clear or adverse weather.

The Army established the requirement for such a system in 1973 and selected Roland after evaluating several alternative systems. In January 1975, Army contractors began transferring the European technology and fabricating a U.S. version of the system.

Testing of the U.S. version began in early 1978. At the same time, the Army was making several studies to determine how best to meet its air defense requirements. There were three studies, including a cost and operational effectiveness analysis (COEA) of Roland and other alternative air defense systems. While not complete, the conclusions definitely pointed to Roland not being the preferred system. The study results were furnished to senior Defense officials for their consideration. In June 1979, the Secretary of Defense approved the limited production of Roland.

REVIEW OBJECTIVES AND SCOPE

In a letter dated May 25, 1979, the Chairman of the Special Subcommittee on the North Atlantic Treaty Organization (NATO) Standardization, Interoperability, and Readiness, House Armed Services Committee, asked that we review the Roland production decision and other issues. The issues were (1) the system's performance deficiencies and readiness for production, (2) the increase in the Roland cost estimates since its selection, (3) the cost and availability of Roland compared to its alternatives, (4) the reasons for and propriety of Roland's increased engineering services cost, (5) the validity of the recommendations by both the Army Systems Acquisition Review Council (ASARC) and the Defense Systems Acquisition Review Council (DSARC) to begin producing Roland in light of the data available to the decisionmakers, and (6) the technical issues raised in support of the decision by the Under Secretary of the Army in correspondence with the Congress.

We reviewed records and interviewed officials of the Army Missile Research and Development and Materiel Readiness Commands, Redstone Arsenal, Alabama; the Army Air Defense

School, Fort Bliss, Texas; and the White Sands Missile Range, White Sands, New Mexico. We also examined records and discussed certain aspects of our review with officials at Headquarters, Department of the Army and the Office of the Secretary of Defense.

CHAPTER 2

EVALUATION OF THE

ROLAND PRODUCTION DECISION

From our discussions with some of the principals, it is apparent that the decision to produce Roland was reached only after extensive deliberations in the Offices of both the Secretary of Defense and the Secretary of the Army.

The test results and the conclusions of the Army air defense studies were unfavorable to Roland. The system had experienced serious technical difficulties during the tests. Estimated program costs had almost doubled since its selection in 1975, and other possible alternatives were judged more cost effective.

There was great reluctance on the part of some ASARC members to recommend canceling Roland (one of the options considered), in spite of the Army Air Defense School's conclusion which showed a preference for other candidate systems--derivatives of the Hawk and Chapparal. The Air Defense School's preliminary report on its cost and operational effectiveness analysis concluded that Roland was less cost effective than either alternative. This conclusion was confirmed in a subsequent study made at the direction of the Under Secretary of the Army just prior to ASARC.

Some of the major considerations going into ASARC's decision to recommend production were:

--Representations by the Army's Materiel Development and Readiness Command that Roland had met most of its required operational capability and was ready for production.

--Reservations about the availability, technical risk, and cost of alternative systems, shown in the Army's COEA to promise greater cost effectiveness than Roland, but considered by senior Army officials to be "conceptual," and therefore, in need of considerable further development.

--Support for Roland voiced by the U.S. Army Command in Europe.

--A desire to sustain the interest of some European members of the NATO alliance to coproduce the Patriot

air defense system. The Army believes this is necessary to protect the flanks of U.S. forces deployed in Europe and to provide an integrated air defense system for NATO.

DSARC's recommendation to begin limited production was based on

--the belief that, of the candidates considered, Roland would best meet the requirement for an all-weather, mobile system and

--the representation that the system substantially met the required operational capability.

It is apparent that the effect of the decision on U.S. initiatives to achieve greater military cooperation with its NATO partners weighed importantly in the recommendations of both ASARC and DSARC. The Under Secretary of Defense for Research and Engineering who chaired DSARC assured us, however, that Roland would not have gotten the approval if the members had not been convinced the system would be an effective addition to the U.S. inventory of weapons. According to the Under Secretary, the NATO issue was over and above the considerations that qualified the system for production.

PERFORMANCE DEFICIENCIES AND READINESS FOR PRODUCTION

Roland has serious deficiences which, so far, have prevented it from meeting some major requirements. Some of the more critical problems, such as its performance in a countermeasures environment, the warhead's lethality, and radar interference are classified and, therefore, cannot be included here. Other problems are described in the following paragraphs.

Unreliable components

Several critical system components proved to be unreliable during the test program. Among others, these include components of the surveillance radar, track radar, power system, and environmental control unit.

Recent test reports have confirmed the system's continuing lack of dependability. For example, the Army's stated requirements envision that the system must ultimately achieve a 90-percent probability of performing its mission for 72 consecutive hours without maintenance beyond the

capability of the battery. On the basis of its showing during the tests, an Army test agency calculated that Roland has demonstrated only a very small probability of performing its mission. (The Army maintains the probability is somewhat better when calculated on the basis of the actual hours of operation during any 72-hour period.)

The lack of dependability is also reflected in the recent increase in the estimated initial spare parts needed to support Roland. The estimated costs increased from $29.8 million to $173 million.

To overcome the problem, the Roland Project Manager has started an accelerated reliability improvement program for selected items considered to be the most troublesome. However, these items do not include all of the critical components considered by Army test officials to constitute major reliability problems.

The items selected are being redesigned, and the related testing is to be completed by December 1980 before award of the first full-scale production contract. The adequacy of these and other reliability improvement modifications is also to be evaluated during confirmatory testing beginning in September 1981.

Adverse weather problems

Problems in operating in adverse weather continue for Roland. Reports published in 1978 on tracking tests held early that year confirm this.

According to a Roland project representative, a modification that is expected to improve the system's performance in adverse weather will be tested in 1980 if approved for implementaton by the United States and Europeans.

Cold weather problems

During its cold weather tests, Roland also failed to function because of the environmental control unit's inadequate design and the temperature sensitivity of some components. Space heaters had to be used to warm the fire unit to the proper operating temperature.

The Army plans to solve this problem by increasing the capability of the heating system and is also considering using a blanket for the track radar.

Maintenance burden

Trying to keep Roland operational may impose a severe burden on the Army's maintenance system. The problem stems from the difficulty in identifying failed components. In most cases, maintenance has been performed by contractor technicians by replacing major components in succession until the faulty item is found. At times, the problem is aggravated by deficient test equipment indicating a fault in the system when the system is working properly.

According to the chief engineer of the Roland Project Office, in an effort to solve the problems, the Europeans have been requested to redesign part of the maintenance equipment. The engineer also said that the Army may develop its own equipment.

Lack of safety testing

The Roland missile has not been subjected to safety qualification tests because it failed less stressful tests. Army test officials expressed particular concern over this matter because European missiles failed their safety tests at White Sands Missile Range.

During those tests, seven of eight European missiles had cracked propellant grains, causing the warheads to leak their explosive. On being fired, a cracked grain is dangerous because the missile might explode on the launch rail.

According to Roland project officials, they do not expect the U.S. missile to have the same problems as the European missile because of differences in design. The U.S. missile is to be subjected to safety qualification tests during the confirmatory test program which begins in 1981.

Other problems

There are other performance problems which we are omitting because they are classified. In addition to Roland's unconvincing performance in testing so far, other important aspects of Roland's performance remain to be tested.

ROLAND'S COST ESTIMATES SINCE ITS SELECTION

Since its selection in January 1975, Roland's program cost estimates have steadily increased from $1.3 billion to a

current $2.4 billion. The following chart shows a history of the increases. The costs are those shown in approved Army programs.

	Jan. 1975	Dec. 1976	Sept. 1977	Sept. 1978	June 1979
	(millions)				
Development	$ 226.6	$ 265.0	$ 276.4	$ 276.4	$ 293.5
Procurement	1,123.1	1,569.8	1,583.4	1,851.1	2,095.3
Total	$1,349.7	$1,834.8	$1,859.8	$2,127.5	$2,388.8

All estimates prior to the latest were parametric estimates using as empirical data the costs experienced on U.S.-developed systems. These earlier estimates were grossly understated. Much of the cost increase resulted from failure to appreciate at the outset the difficulties involved in transferring the European technology. Other reasons for the increase were attributed by the Army to inflation and increases in hardware costs, spare parts, and production facilities and engineering services costs.

The current estimate of $2.4 billion still appears low. It excludes the costs of an improvement program now being formulated to permit Roland to meet the projected 1987 threat.

Plans for the improvement program have not been finalized. However, we identified estimated development costs of about $12 million associated with three of the improvements being considered. These relate to an automated track radar, a guard antenna for the search radar, and an improved communications system. According to Army officials, the development cost of a new warhead and other possible improvements had not been estimated.

The procurement cost estimate of $2.1 billion does not consider an affordability issue which could result in stretching out the acquisition program and cause further increases such as the program has experienced in the past. For example, when the Army's fiscal year 1979 budget request for Roland was reduced by $35.1 million from $200.1 million to $165 million, the Army increased the total procurement estimate by $72 million to compensate for the resulting deferred procurement of some quantities to later in the program.

An estimate of $3.7 billion cited by the Defense Audit Service covers the cost of deploying Roland in Army divisions as well as in the rear area. Thus, it should not be compared to the preceding estimates which are for the rear area requirements only. The COEA's May 1978 estimate of the investment cost is about $575 million lower than shown in the September 1978 approved Army program. The COEA estimate (1) was made 4 months earlier, (2) correctly excluded sunk research and development costs up to the time it was prepared, and (3) is in constant fiscal year 1978 dollars, whereas, the program estimate includes an inflation factor for the balance of the program's duration.

COST AND AVAILABILITY OF ROLAND AND ALTERNATIVE SYSTEMS

The following chart shows the comparative investment cost estimates used for the COEA.

	Roland	I^2 Hawk	Chaparral FLIR/POST (notes a and b)
	(millions)		
Research and development	$ 29.0	$15.3	$ 24.1
Procurement	1,523.3	81.0	190.9
Total	$1,552.3	$96.3	$215.0

a/Forward Looking Infrared Radar.

b/Passive Optical Seeker Technique.

On June 21, 1979, we obtained the following updated estimates of the investment cost from the three project offices.

	Roland	I^2 Hawk	Chaparral FLIR/POST
	(millions)		
Research and development	$ 18.3	$21.4	$ 39.4
Procurement	1,865.4	50.5	385.1
Total	$1,883.7	$71.9	$424.5

Hawk costs include the cost of design changes and developing, testing, and producing modification kits. The cost is based on the assumption that enough Patriots will be available to replace the Hawks as they are converted. If not, there would be a need to buy additional Hawks. Chaparral costs include, in addition to the development of the FLIR and POST seeker, procuring 105 additional fire units and about 2,600 new missiles.

The COEA costs, in fiscal year 1978 constant dollars, are lower except in the case of I^2 Hawk. We believe the earlier Hawk estimate may have been overstated, since it represented the cost of converting eight battalions of Hawks, including some not needed for the low-flying air defense mission. The June 1979 figures include only Hawks needed for that mission.

The change in Roland's investment cost, in addition to the inflation factor, results from the elimination of sunk costs incurred since May 1978.

Operation and support costs used in the COEA were:

	(Millions)
Roland	$1,302.3
I^2 Hawk	1,552.7
Chaparral	1,024.3

Some of the data used in the studies can be questioned. Examples are:

--The estimated operation and support costs for the I^2 Hawk appear to have been understated by 20 to 50 percent due to a calculation error. Roland would be more competitive with that alternative. 1/

--Certain performance improvements being considered for Roland were not evaluated in the studies. These, also, could have made Roland more competitive.

1/The Army's study director advised us that after allowances for this error I^2 Hawk was still more effective and less costly than Roland.

--However, Roland was credited with having certain improvements which increased its performance capability, but was not charged with the related cost of the improvements. This factor would overstate Roland's relative cost effectiveness.

--Chaparral's performance capability appears to have been significantly understated in the study because it did not fully take into account the target detection capability of the FLIR device in adverse weather.

Technical feasibility of alternatives

The alternatives appear to be technically feasible. The I^2 Hawk is based primarily on the acquisition of additional Hawk equipment already in production and requires only minor hardware changes to provide for control of an additional fire section.

The technology for the Chaparral/FLIR is essentially the same as that developed for the TOW missile system, the M60A3 tank, and the advanced attack helicopter. The FLIR device enhances engagement capability at night and in certain visibility degrading weather conditions, such as clouds or fog. Production deliveries of FLIR components, many of which can be used in Chaparral, are scheduled to begin under the TOW and M60A3 programs in late 1979.

The POST seeker, a potential improvement to the Chaparral, is being developed under the Stinger missile program. According to Stinger project representatives, the POST program is proceeding satisfactorily. Design evaluations show that the seeker can be readily incorporated in the Chaparral missile.

The improved Chaparral is credited with achieving a higher probability of kill than Roland, under certain countermeasure conditions.

Further upgrading Chaparral to an all-weather configuration is based on adding the British-made Blindfire radar, used with the British Rapier system. Using this radar with Chaparral was successfully demonstrated in a firing program completed in early 1978. However, the system demonstrated was not a tactically configured system and all firings were in clear weather.

The deployment time frames for Roland and the alternatives based on Army project office estimates are about the same.

Achieving Roland's schedule assumes that the procurement program will be funded at higher levels than currently allocated. The schedule for I^2 Hawk assumes that the program will begin in fiscal year 1981. Starting in fiscal year 1980 could accelerate the program by as much as 1 year.

At this time, however, the I^2 Hawk program is not approved. The project manager's projection contemplates a 3-year development program consisting primarily of testing.

The Chaparral/FLIR deployment is based on starting the program in fiscal year 1980, integrating the POST seeker in fiscal year 1981. According to Chaparral project representatives, the POST program could be accelerated if authorization were given to start the program in fiscal year 1980.

The COEA is still in progress and final reports on the other air defense studies by the Air Defense School are not yet published.

So far as the COEA is concerned, changes in costs and relative effectiveness were still being derived from continuing analysis up to the time we prepared this report. We are, therefore, unable to offer a final assessment of its validity. We do not anticipate, however, that any further changes in the results involving either cost or effectiveness would be of sufficient magnitude to change Roland's relative ranking in the preliminary report, as compared to the other candidates.

The other air defense studies address various concepts for providing air defense. None of these favored using Roland to augment Patriot in defending critical assets in the rear area.

If the conclusions of Roland's COEA and the other air defense studies stand up in the final report and the report gains acceptance, we believe the Army may have to reconsider Roland's role in the air defense mission.

INCREASED ENGINEERING SERVICES COST

This issue was not pursued in depth, due to the time constraints on this review. However, on the basis of a limited examination, Roland's engineering services cost estimate has increased from $70.8 million to $398.6 million largely because effort traditionally funded by the research and development appropriation is being funded by the procurement appropriation. According to Army regulations, some of the services should have been funded by the research and development appropriation.

Because of the general wording of certain contract provisions in the engineering services contract, it was difficult to determine specifically what the contractor is supposed to be doing. For example, the contract provides, in part, that the contractor will "perform Fire Unit engineering studies and analyses as requested * * *."

We, therefore, asked the Army contracting officer to describe more specifically what the contractor was required to do and the reason for the relatively high cost when compared to the engineering services cost on U.S.-developed systems. According to the contracting officer, the contractor was accomplishing activities traditionally done during the development phase and funded by the research and development appropriation. The contracting officer cited the producibility engineering and planning. This is oriented toward development of manufacturing processes and, according to Army regulations, is supposed to be funded by the research and development appropriation.

The contracting officer estimated that at least one-half of the $93.2 million applicable to engineering services in fiscal years 1978 and 1979 would have been funded by the research and development appropriation if the Roland program had been a traditional U.S. development program.

Also cited were efforts to solve the system's reliability and other performance problems. We could not readily determine whether the contractor has been or is performing these activities. However, we discussed the matter with Roland project engineers, and they confirmed the contracting officer's explanation. They also told us that there was no documentation showing that the contractor was required to perform these specific activities.

We asked the Roland project's legal representative to cite the authority for funding such activities with procurement appropriation funds. For the correction of performance problems, the representative cited an Army regulation, AR 70-15, governing product improvement programs. However, the regulation applies to items classified for production. At the time procurement funds were authorized, Roland had not been approved for production.

With respect to producibility engineering and planning, the legal representative told us that Army regulations do not apply to the Roland program because the regulations apply only to the "materiel developer" which in Roland's case was the European consortium.

We are not aware of any Army fiscal regulations that distinguish between weapon system programs involving the transfer of technology from foreign developers and programs developed in the United States. The regulations address the type of effort undertaken--not the source of the effort.

ARMY AND DEPARTMENT OF DEFENSE PRODUCTION DECISIONS

ASARC III met on April 24, 1979, and DSARC III was held on May 31, 1979. ASARC concluded that Roland should enter production and DSARC recommended a low rate of production for Roland. In a June 6, 1979, memorandum, the Secretary of Defense gave approval to the Secretary of the Army for Roland to enter a low-rate production program. A DSARC IIIB is to be conducted before Roland enters full production.

Data available to ASARC/DSARC

These principal findings of the major ongoing studies prepared by the U.S. Army Air Defense School were available to ASARC/DSARC decisionmakers.

--High- and Medium-Altitude Air Defense (HIMAD) Study--This April 4, 1979 study was to determine Army requirements for an effective, viable, high- and medium-altitude air defense.

> "A complementary system is required to enhance Patriot survivability and deny threat planners the low altitude attack option. Based upon analysis to date, the most effective system to serve as the Patriot complement is the dual or multichannel I Hawk."

--Cost and Operational Effectiveness: U.S. Roland Air Defense System--This April 1979 study was to determine the most cost-effective SHORAD alternative.

> The dual or multichannel I Hawk is the preferred all-weather system over Roland to supplement Patriot in the defense of critical, rear-area assets.

--SHORAD/MANPAD Force Structure Study--This April 1979 study was to determine the preferred SHORAD missile system for the division air defense force in conjunction with coverage provided by the HIMAD force.

> "ICHAP-FLIR-POST is the preferred alternative for the SHORAD missile system."

Before ASARC convened, an Independent Air Defense Review Group, chaired by the Deputy Under Secretary of the Army for Operations Research, reviewed the studies. The group concluded that although the studies had shortcomings, the conclusions that Roland was not the preferred complement to Patriot in the rear areas were valid. The group also concluded that Roland was so expensive that no combination of factors could change the cost-effectiveness conclusions.

We, too, believe that it would take a series of major errors to make the Roland system more cost effective than the alternatives preferred in the studies. Also, since the studies basically dealt with the 1987 time frame, we believe the achievement of the relatively modest "conceptual" improvements to Chaparral and Hawk by 1987 is reasonable to anticipate.

How ASARC reached its decision

To determine how ASARC reached its decision, we interviewed individuals present at ASARC. The rationale for the ASARC production decision appears to evolve from a number of considerations. These concern system requirements, the COEA and other major air defense studies, international commitments or initiatives by the United States, and technical readiness of the candidates. The following paragraphs show ASARC's conclusions and our assessment.

Before considering the COEA and other major studies, ASARC reached an affirmative conclusion on these questions: (1) Does Roland meet the stated requirement? (2) Is Roland ready for production--that is, do contractors have the necessary production facilities, capabilities, etc.

In our opinion, the test results to date which show major shortcomings in Roland's availability, maintainability, and coping with a variety of countermeasures do not support this conclusion.

ASARC was aware that COEA and other studies--which are still in draft form--indicated that Roland is not as cost effective as certain alternatives. The leading alternatives were the Chaparral/FLIR/POST and the dual and multichannel Hawk. ASARC rejected Chaparral/FLIR/POST on the grounds that POST seeker is still in engineering development and the availability of the system and its performance capability were, therefore, still uncertain. The All-Weather Chaparral was rejected because it uses the Blindfire Radar used in the British Rapier system which would require an offshore buy.

The dual and multichannel I^2 Hawks were rejected because they were believed to require too many personnel to operate and this factor would seriously drain the Army's available manpower.

Considering the development which has already gone into FLIR and POST for use in other systems and the technical difficulties being experienced by Roland, we believe that at this stage it is uncertain that Roland could be made operational much sooner than the modified Chaparral.

At the time the preliminary report on the COEA was completed the manpower requirements appeared to be a detriment to selecting the Hawk. However, information we obtained from personnel at Fort Bliss indicated that the most recent analyses are showing that effectiveness equal to Roland's can be obtained with much less manpower than originally thought possible--that is, with the use of substantially fewer Hawk assault fire units.

ASARC concluded that the Roland system would be available at an earlier date than the alternative systems.

If Army projections we obtained are credible, the estimated dates for completing deployment of Roland and the leading alternatives are fairly comparable.

The effect on the United States defense posture in Europe was another consideration in the ASARC production decision. ASARC concluded the United States' use of Roland is a key factor in European considerations to coproduce Patriot. The Army considers the purchase of Patriot by the NATO alliance as necessary to provide an integrated NATO air defense and to protect the flanks of U.S. forces deployed in Europe.

How DSARC reached its decision

DSARC was briefed by the Deputy Under Secretary of Defense for Research and Engineering (Tactical Warfare Programs) staff. The briefing included the test results and how they compared with the Roland requirements. Roland had met requirements pertaining to response time against stationary and moving targets at various ranges with the targets maneuvering and traveling at certain speeds. The results also showed that testing had been in a mild electronic countermeasure environment and that the system was far short of meeting the 72-hour operational requirement without maintenance above the battery's level of capability.

A list of concerns about the system was presented next, together with a schedule of planned corrective action. The concerns involved the capability of Roland's electronic counter countermeasures; the adequacy of the track and surveillance radars; performance in adverse weather; the capability of the warhead; the system's identification friend-or-foe device; and command, control, and communications. These concerns required either more testing or further development.

DSARC was also briefed on the Air Defense School studies, including what were considered shortcomings in COEA. Roland's cost growth was also discussed.

In our opinion, the briefing was a fair presentation of Roland's status, although, possibly differing in some respects with the scoring of the test results.

The alternatives considered were to (1) cancel Roland, (2) approve the Army's procurement plan, or (3) approve buying a lesser quantity--72 fire units, sufficient to equip U.S. forces in Europe but none in the United States.

The rationale for DSARC's affirmative production decision appears to evolve from two major considerations, the need for an all-weather system and the need for a mobile system. The fact that the decision was to start with low-rate production reflects some concern for Roland's not achieving several key operational requirements in testing to date.

Roland's ineffective performance in adverse weather was mentioned earlier in this report. We believe mobility may not be a key factor if Roland is deployed in the corps and rear area as planned. As recently as May 1979, the Army was considering alternative Roland configurations which included a fixed-position Roland. This alternative assumes fortifying a fixed-position Roland, with transportation to be provided by helicopter lift.

We discussed the extent to which commitments and U.S. initiatives in Europe relating to arms cooperation influenced DSARC's recommendation with the Under Secretary of Defense for Research and Engineering. While acknowledging the difficulties in pursuing these initiatives if Roland were canceled, the Undersecretary added that this was not a factor in the decision.

The Under Secretary reiterated the importance of NATO's forces, which flank U.S. positions in the Central Region, to

have a system such as Patriot to help reduce the threat to our own forces. In addition, if the Europeans undertake development of their own replacement systems instead of accepting Patriot, it could involve a costly 10-year development process.

The United States is involved in getting the members of the alliance to commit more resources to NATO's common defense than they have in the past, thereby, reducing the United States burden. The Under Secretary believes that if, for example, the European members of NATO do not agree to Patriot, the United States may have to acquire more Patriots to reinforce our troops, thus, aggravating the affordability problem facing the Army as it tries to modernize its weapon systems inventory.

TECHNICAL ISSUES RAISED IN SUPPORT OF PRODUCING ROLAND

In corresponding with the Armed Services Committee last April, the Under Secretary of the Army raised several technical matters about Roland and the principal alternatives, the improved versions of existing Chaparral and Hawk.

Essentially, the Under Secretary felt that there was sufficient technical difficulty in the proposed improvements to raise doubts about either alternative system's availability in the desired time frame. The Under Secretary discussed scenarios where Roland promised to be more effective than either alternative. Our view is that the Under Secretary's observations are correct but would apply only in infrequent battle conditions. Also, the technology demanded by the proposed improvements to the alternatives is sufficiently advanced to make it low risk.

CHAPTER 3

DEPARTMENT OF DEFENSE COMMENTS, OUR EVALUATION, AND CONCLUSION

In a June 26, 1979, letter the Under Secretary of Defense for Research and Engineering responded to a draft of this report. The principal comments, and our evaluation of them, follow.

The Under Secretary maintained that Roland's performance is superior to the Chaparral and Hawk alternatives. The Under Secretary considered (1) Chaparral's performance in certain adverse weather conditions to be inadequate and (2) Hawk's mobility to be inferior.

In our view, the superiority claimed for Roland is not readily discernible. Whether threat aircraft would attack during weather conditions cited by the Under Secretary is questionable. Also, the Under Secretary's position with respect to Chaparral's inadequate performance seemingly ignores Roland's own problems in adverse weather. While Roland's mobility is better than Hawk's other factors such as Hawk's greater range capability should also be considered.

Also, mobility may not be a key factor in the corps and rear areas which are far removed from the front and where there is less need for rapid movement to new positions.

The Under Secretary also maintained that the Hawk alternative is of a conceptual nature and that because of the technological risks, it is virtually inconceivable that the Hawk alternative could be fielded in a time frame competitive with Roland.

We agree that risks are involved, as they are in any development program. However, proposed improvements to the Hawk are based primarily on buying more Hawk equipment already being produced. Thus, the risks should not be any greater than those attendant with Roland.

We also believe that categorizing the improved Hawk as "conceptual" is misleading since the term usually connotes that extensive design is required. Our understanding is that only minor hardware changes would be required. Perhaps the use of the term "conceptual" connotes more the fact that it is not yet an approved Army program.

The Under Secretary also pointed out that the Hawk requires more manpower than Roland.

The Air Defense School is continuing to study this question. In our latest discussions, the study director indicated that the studies are now showing that equal effectiveness with Roland may be achieved by Hawk with considerably less than the 27 assault fire units used in evaluating Hawk earlier in the COEA. This should create a substantial reduction in manpower requirements.

The Under Secretary also disagreed with our view that Roland has serious deficiencies and, therefore, is not ready for production. The Under Secretary maintained that our view was not soundly based and pointed out that it was always recognized that under an expedited schedule (supported by the Congress), a production decision on Roland might have to be made before all desirable test data had been accumulated. The Under Secretary also expressed confidence that current deficiency corrections will solve Roland's reliability and availability problems and that modifications to handle the projected threat can be added at moderate cost.

Our views on Roland's performance and production readiness were based on:

(1) Reports prepared by the Army test community.

(2) The number and seriousness of the problems experienced in testing.

(3) Our belief that the Army should have reasonable assurance that a system will be satisfactory for combat use before becoming committed to its production.

Other comments in the Under Secretary's letter reiterated those mentioned earlier in this report or dealt with classified subjects which cannot be discussed here.

CONCLUSION

The decision to begin producing Roland is based on the assumption that the system has sufficiently demonstrated its ability to perform its short-range air defense mission in adverse weather.

In testing to date, Roland falls short of meeting several important requirements. It has shown a very low probability of performing a 72-hour mission without major maintenance. This contrasts with a specified 90-percent probability requirement. Modifications will have to be devised to improve its vulnerability to projected countermeasures and to correct other problems. Because testing performed so far has not been rigorous enough to assess its expected threat capability and that its testing in adverse weather has been limited, the decision to begin production appears premature.

Further testing of Roland may show the superiority over other candidates that the Army claims for it. At this point this is not readily discernible.

It is difficult to support or fault the Department of Defense's decision because to a great extent it was based on judgment. Such matters as the proper confidence level in Roland's ability to overcome its technical problems, it prospects for achieving the desired reliability, and its capability to meet certain threats, are all arguable.

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