

112673

BY THE COMPTROLLER GENERAL

**Report To The Chairman, Subcommittee  
On Defense, Committee On Appropriations  
House Of Representatives**

OF THE UNITED STATES

**Late Fire Control System Deliveries For  
Army's M-60A3 Tanks Jeopardize  
Combat Readiness Improvements**

Delayed deliveries of fire control systems for the Army's M-60A3 tank production and conversion program are causing deployment and program slippages. Future deliveries are also uncertain. As a result, improvement in combat readiness is slowed down, the Army is storing hundreds of incomplete tanks at additional cost, and Army depot workloads are reduced.

The Department of Defense and the Army sell M-60A3 tanks to foreign governments. They should, however, consider giving higher priority to the depot conversion program so that combat readiness improvements will be accelerated and depot staff reductions minimized.



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

IN REPLY  
REFER TO:

B-198917

The Honorable Joseph P. Addabbo  
Chairman, Subcommittee on Defense  
Committee on Appropriations  
House of Representatives

Dear Mr. Chairman:

As you requested, we reviewed the impact of late deliveries of fire control systems on the Army's M-60A3 tank production and conversion program.

Late deliveries have delayed improvements in the combat readiness of U.S. forces, have caused the Army to store hundreds of tanks at additional costs, and have reduced the workload of Army depots, especially the Anniston Army depot. While the Army has taken actions to assure future deliveries of fire control systems, some uncertainty on future deliveries of fire control systems still remains. If deliveries are to be delayed further, Army depots could experience further decreases in their workloads.

To minimize the impact of such workload decreases, the Army could consider (1) giving higher priority to the M-60A3 depot conversion program than to deliveries of new tanks to foreign governments until its needs for fire control systems are satisfied or (2) providing foreign governments with an earlier version of the M-60 tank series. However, both options require renegotiation of the foreign sales agreements.

As you requested, we did not obtain written comments from the Department of the Army or the contractors.

Copies of this report are being sent to the Chairmen, House Committees on Armed Services, on Appropriations, and on Government Operations; the Chairmen, Senate Committees on Appropriations, on Armed Services, and on Governmental Affairs; the Director, Office of Management and Budget; and the Secretaries of Defense and the Army. Copies will be made available upon request to other interested parties.

Sincerely yours,

Acting Comptroller General  
of the United States



COMPTROLLER GENERAL'S REPORT  
TO THE SUBCOMMITTEE ON DEFENSE  
COMMITTEE ON APPROPRIATIONS  
HOUSE OF REPRESENTATIVES

LATE FIRE CONTROL SYSTEM  
DELIVERIES FOR ARMY'S  
M-60A3 TANKS JEOPARDIZE  
COMBAT READINESS IMPROVEMENTS

D I G E S T

The Army is experiencing delays in converting M-60A1 tanks to A3s and deploying newly produced M-60A3 tanks due to shortages of fire control systems. As a result, not all new tanks will be equipped with such systems, and few conversions will be accomplished in fiscal years 1980 and 1981.

The M-60A3 tank is the most modern tank currently in the U.S. inventory. It has an increased first round hit capability over the M-60A1 due to the incorporation of a laser rangefinder and a solid state computer into the fire control system. The current M-60A3 program calls for 3,596 tanks--1,561 new tanks and 2,035 converted M-60A1 tanks. Production and conversion costs for this program are estimated at \$1.75 billion.

LATE DELIVERIES OF FIRE CONTROL  
SYSTEMS AFFECT THE M-60A3 TANK PROGRAM

Since the inception of the M-60A3 tank program in 1976, deliveries of fire control systems from two producers--Hughes Aircraft Company and Kollsman Instrument Company--have not been adequate to meet Army requirements for producing M-60A3 tanks and for converting M-60A1 tanks to the A3 configuration.

The Army considered a number of options to minimize the impact of these delivery problems on the readiness of U.S. forces and depot maintenance workloads. After assessing each option, the Army decided to take the following two major actions:

--Produce new tanks according to schedule and store them, to the extent necessary, until fire control systems become available.

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--Delay the start of the M-60A3 conversion program at the depots and substitute another conversion program in its place. (See pp. 7, 11, and 12.)

The overall effect of these late deliveries and the Army's actions have resulted or will result in:

--Delaying improvements in the combat readiness of U.S. forces, especially in Europe. Currently 480 tanks, representing about 8 tank battalions, cannot be deployed because of incomplete fire control systems. (See p. 10.)

--Reducing the Anniston Army depot's fiscal years' 1980 and 1981 combat vehicle workloads by 38 and 65 staffyears, respectively. (See pp. 10 and 11.)

--Incurring extra production costs of about \$5.8 million. These costs will be incurred to preserve stored tanks and to complete the production process when fire control systems become available. (See pp. 8 to 10.)

#### FUTURE DELIVERIES ARE UNCERTAIN

Periodic changes in the projected fire control system delivery schedules over the last 3 years have resulted in corresponding schedule changes to the M-60A3 tank deployment and conversion program.

A new delivery forecast, made in April 1980, anticipates further delivery slippages. This forecast may be optimistic because of:

--Continuing changes occurring in the fire control system design. (See pp. 14 and 15.)

--One producer of fire control systems has not yet demonstrated its ability to produce fire control systems in quantity, and the other producer, after 2 years of production, has not yet consistently achieved the scheduled production rate. (See pp. 15 to 17.)

SALES TO FOREIGN GOVERNMENTS  
AFFECT READINESS AND DEPOT WORKLOADS

In allocating future fire control systems, the Army gave foreign governments a higher priority than it did to its own depot conversion program. The Army believes that certain benefits would be derived from such action. First, sales of M-60A3 tanks to foreign governments will allow the Army to maintain a warm production base when U.S. requirements cannot support continued production at the Detroit Arsenal Tank Plant. Also, such sales will allow the Army to retain two fire control system producers, rather than one, which will result in prompt delivery of fire control systems. However, the higher priority given to foreign sales, coupled with late deliveries, resulted in delaying the start of the depot conversion program by about 15 months. The conversion delay has caused tank deployment schedules to slip and has slowed down readiness improvements for U.S. forces. (See pp. 20 and 21.)

Slippage in the conversion program has contributed to the steadily declining workload at the Anniston Army depot, thereby increasing the risk that any future workload reductions will require staff reductions in addition to those achievable through attrition. Such staff reductions could decrease the depot's ability to accommodate any rapid increase in its tank maintenance workload that can occur during a national emergency. (See pp. 21 and 22.)

At least two options are available to reduce the impact of foreign sales orders on the depot conversion program. One will delay the delivery of M-60A3 tanks to foreign governments until sufficient fire control systems are available to satisfy the depot conversion program. The other option is to furnish foreign governments with the M-60A1 RISE PASSIVE tank. This tank is the immediate predecessor to the M-60A3, but its fire control system is not as advanced as the M-60A3's.

Implementation of either option should enable the Army to start and complete its conversion program sooner. However, both options require renegotiation of the foreign sales agreements. (See p. 23.)

MATTERS FOR CONSIDERATION  
BY THE COMMITTEE

The Committee should obtain the views of the Departments of Defense and the Army concerning:

- The impact of the M-60A3 tank sales to foreign governments on the combat readiness of U.S. forces and the short- and long-term impact on Army depot workloads.
- The feasibility of (1) delaying the delivery of the M-60A3 tanks to foreign governments until sufficient fire control systems are available to satisfy the depot conversion program and (2) furnishing foreign governments with earlier versions of the M-60 tank series.

AGENCY COMMENTS

As requested by the Committee, GAO did not obtain written comments from the Department of the Army or the contractors.

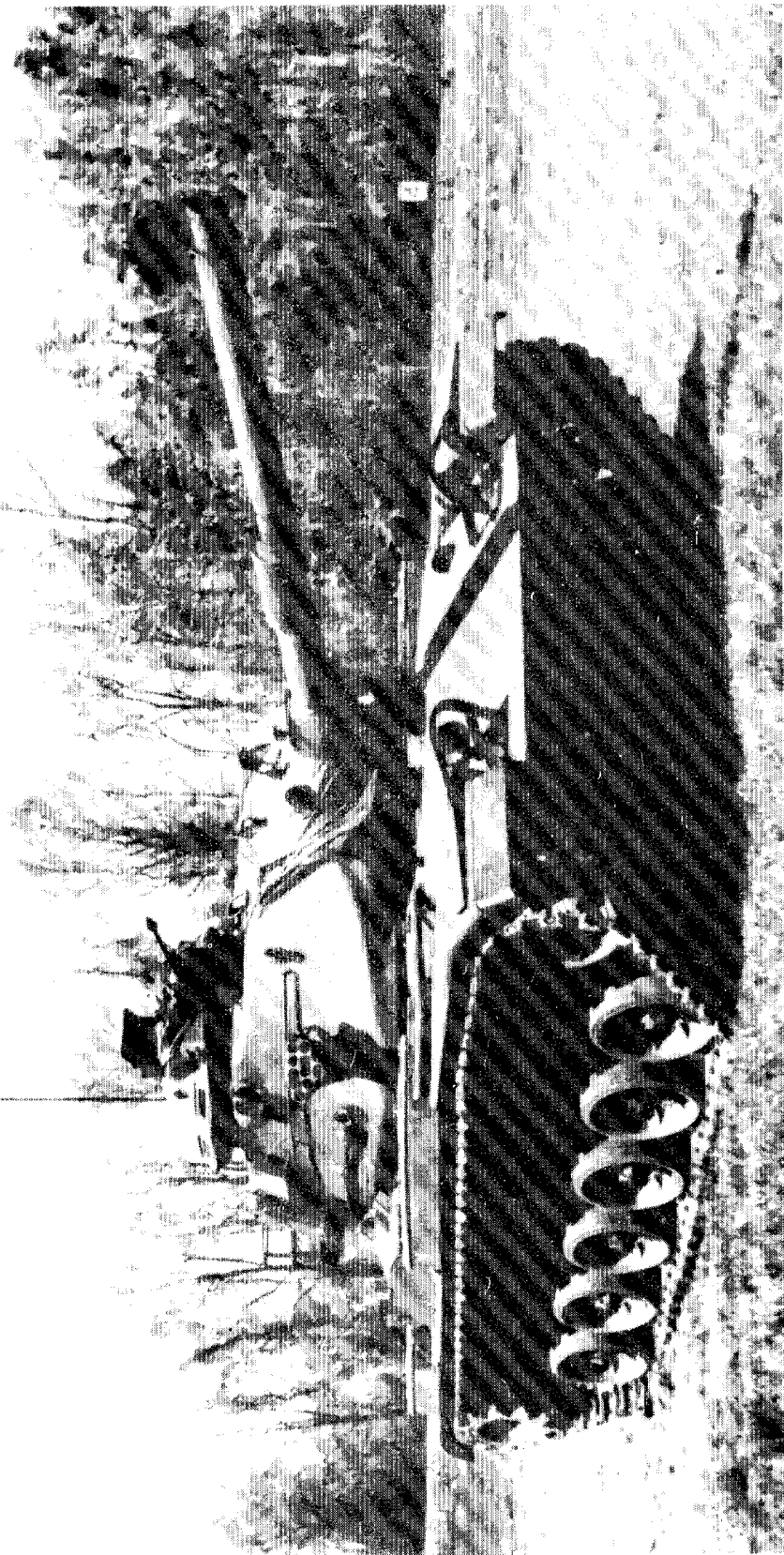


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M-60A3 TANK

COURTESY OF THE U.S. ARMY



## CHAPTER 1

### INTRODUCTION

The Army is experiencing delays in converting its M-60A1 tanks to the M-60A3 configuration and in deploying newly produced M-60A3 tanks due to shortages of fire control systems. According to the original conversion and production plan, the Army, in fiscal year 1981, needs 450 systems for the conversion program and 416 systems for the production program. However, due to these shortages, not all new tanks will be equipped with fire control systems during fiscal year 1981 and few tank conversions, if any, will be accomplished during the same fiscal year.

The Subcommittee on Defense, House Committee on Appropriations, was concerned about these shortfalls and asked us to review the Army's problems, proposed solution, and their impact on the depot maintenance program.

### BACKGROUND

A major goal of the Army is to have the most modern tanks available to counter the ever increasing threat of Warsaw Pact forces to Western Europe. During fiscal year 1979 hearings before the House Committee on Appropriations, the Army testified that " \* \* \* the qualitative edge we have in our current tank fleet is gone, and it is imperative to modernize the tank force now."

Two efforts were initiated by the Army to achieve this modernization. One effort involved introducing a new tank, the XM-1, into the tank fleet in the largest numbers and as fast as possible. The other effort involved converting M-60A1 tanks to the more modern M-60A3 configuration and producing new M-60A3 tanks. M-60A3 tanks are considered equal to the latest Russian tanks--the T-72s--and available to the U.S. forces sooner than the XM-1.

The M-60A3's increased capability over the M-60A1 is due to the more advanced fire control system. The M-60A3 fire control system consists of two major components, a laser rangefinder and a solid state computer. (See pp. 3 and 4 for pictures of a rangefinder and a solid state computer.)

Under the current program, the Army will buy 1,561 new tanks and convert 2,035 M-60A1 tanks for a total of 3,596 M-60A3 tanks. Program costs are estimated at \$1.75 billion, including about \$1.1 billion for production and \$649 million for conversion. The cost of the fire control system for the

conversion portion is about \$498 million, or \$245,000 for each system. 1/

#### MANAGEMENT OF THE M-60 PROGRAM

The M-60 project manager, who is part of the U.S. Army Tank-Automotive Materiel Readiness Command, has overall management responsibility for the M-60A3 tank program.

Chrysler Corporation is the prime contractor for producing new M-60A3 tanks. Two Army depots at Anniston, Alabama, and Mainz, Germany, are to convert M-60A1 tanks to the A3 configuration.

The Project Manager has delegated technical and procurement responsibilities for the M-60A3 fire control systems to the U.S. Army Research and Development Command. The command has contracted with Hughes Aircraft Company (Hughes) and Kollsman Instrument Company (Kollsman) to produce these systems.

The command contracted with Hughes because of the company's prior experience in developing prototype fire control systems and its involvement in developing the technical data package necessary to produce the M-60A3 fire control system. The command later awarded a contract to Kollsman.

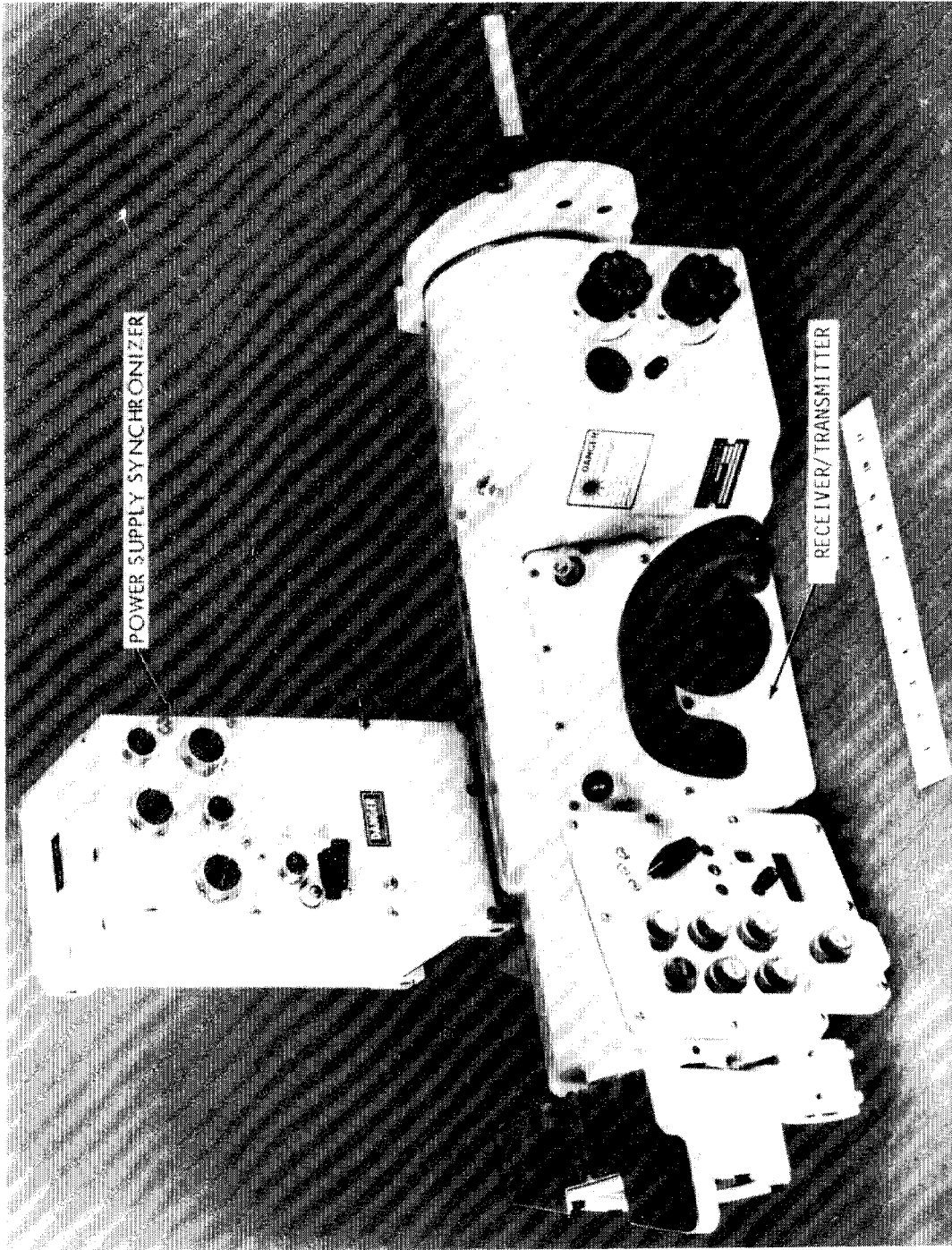
The procurement strategy chosen by the Army was the "leader-follower" concept. Under this strategy, the Army gave Hughes, the leader, the responsibility for designing the system and for providing technical assistance to the follower, Kollsman. Additionally, Hughes was to ensure the adequacy of the technical data package for production.

#### SCOPE OF REVIEW

In accordance with agreements reached with the House Committee on Appropriations, we focused our review on (1) determining the impacts the delayed deliveries of fire control systems had on the Army's tank deployment schedules and the depot maintenance programs and (2) evaluating options available to the Army to minimize these impacts.

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1/The cost of the fire control systems for new tanks is included in the total cost of the M-60A3 tank, which is currently about \$1 million a tank.

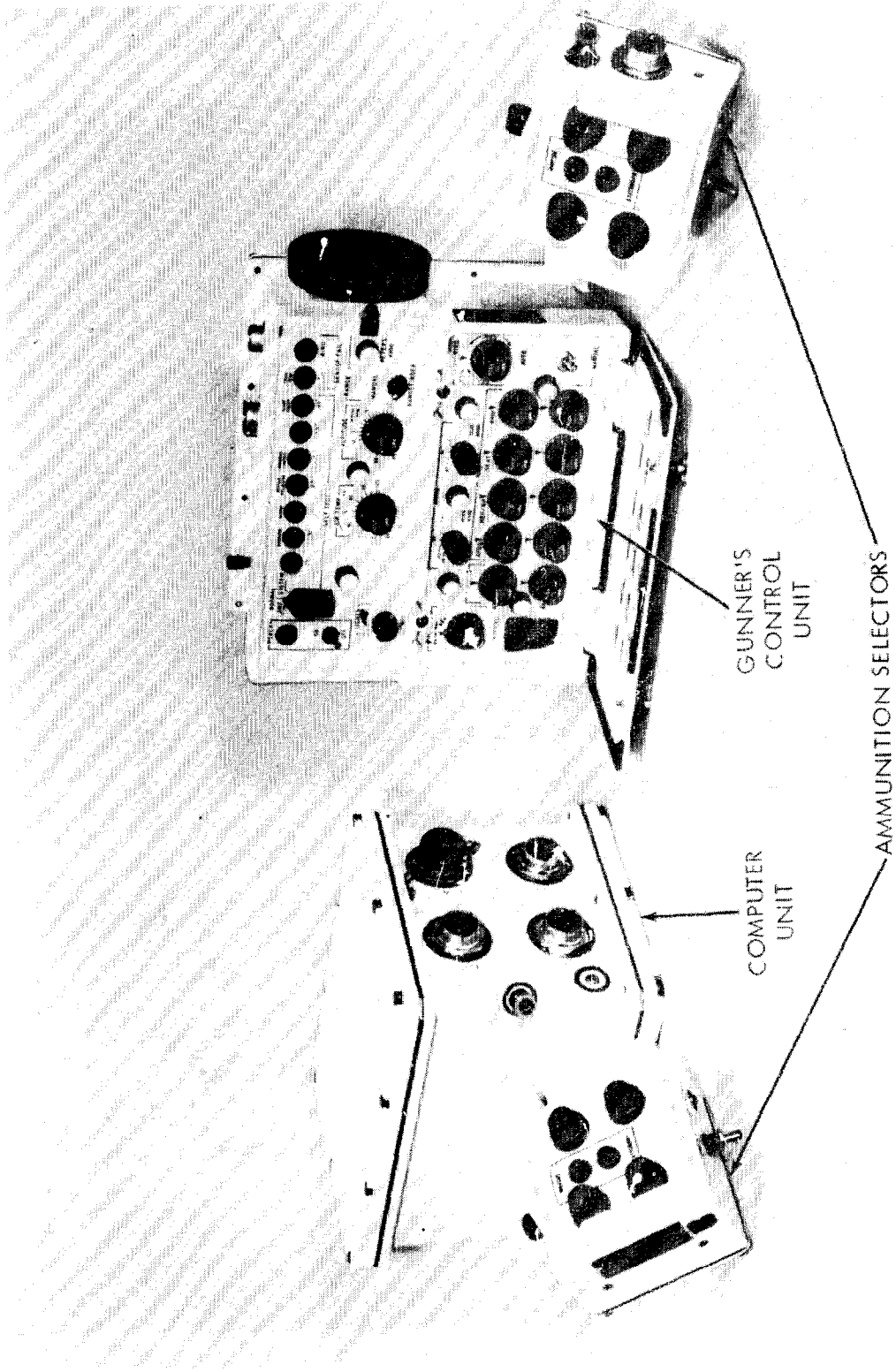


POWER SUPPLY SYNCHRONIZER

RECEIVER/TRANSMITTER

AN/VVG-2 LASER RANGEFINDER SYSTEM

COURTESY OF THE U.S. ARMY



GUNNER'S  
CONTROL  
UNIT

COMPUTER  
UNIT

AMMUNITION SELECTORS

XM21 SOLID STATE COMPUTER SYSTEM

COURTESY OF THE U.S. ARMY



We did not review the causes for the delivery slippages because of ongoing negotiations and possible litigation involving the Army and Hughes for the fire control systems. These negotiations revolve around the question of whether the Army is entitled to \$8.5 million in liquidated damages because Hughes has not met the negotiated delivery dates.

We reviewed Army directives, studies, and other documents and interviewed Army and contractor officials at the following locations:

- Headquarters, Department of the Army, Washington, D.C.
- U.S. Army Materiel Development and Readiness Command, Alexandria, Virginia.
- U.S. Army Tank-Automotive and Materiel Readiness Command, Warren, Michigan.
- U.S. Army Research and Development Command, Dover, New Jersey.
- Detroit Arsenal Tank Plant, Warren, Michigan.
- Depot System Command, Chambersburg, Pennsylvania.
- Anniston Army Depot, Anniston, Alabama.
- Hughes Aircraft Company, El Segundo, California.
- Kollsman Instrument Company, South Merrimack, New Hampshire.

## CHAPTER 2

### LATE DELIVERIES OF FIRE CONTROL SYSTEMS

#### ADVERSELY AFFECT ARMY TANK PROGRAMS

Late deliveries of fire control systems by two contractors have resulted and will result in

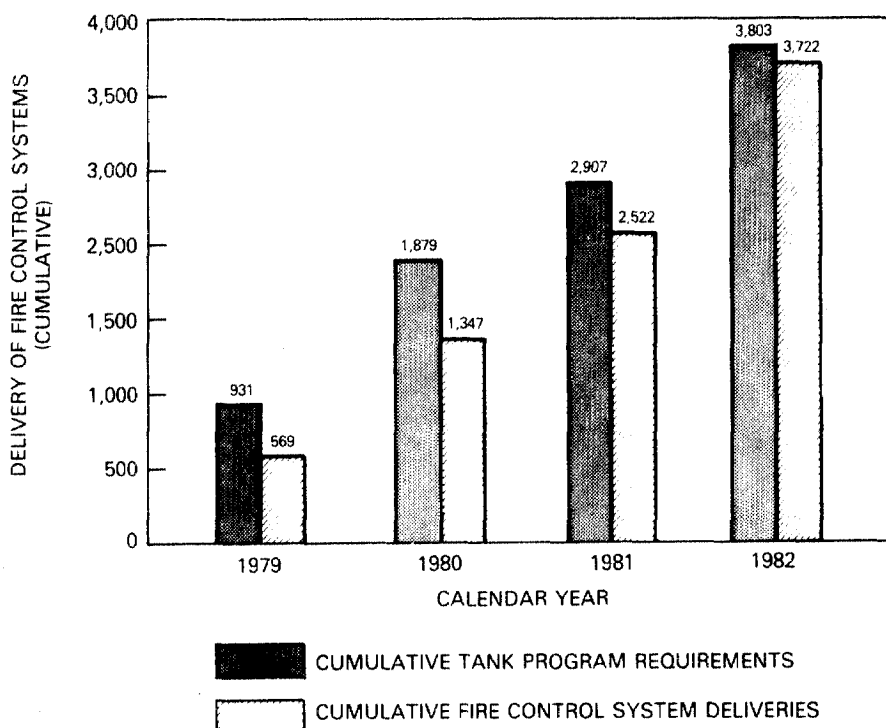
- delaying improvements in the combat effectiveness of Army forces, especially in Europe;
- incurring extra costs of about \$5.8 million to store tanks and to complete tank production;
- delaying the tank conversion program at the Mainz and Anniston Army depots; and
- reducing the workloads at the Anniston and Mainz Army depots during fiscal years 1980 and 1981.

The Army was forced to change its deployment and conversion plans because of the late deliveries. Further, to avoid large price increases by the tank producer, the Army had to store 888 new tanks which lacked fire control systems. As of May 30, 1980, the Army was still storing 480 tanks.

The tanks still in storage represent an investment of about \$300 million and comprise over 4 percent of the Army's tank inventory. As discussed in chapters 3 and 4, future M-60A3 production and conversion and M-60A3 tank deployments are further complicated by the continuing uncertainties of the two contractors to deliver fire control systems and by foreign military sales.

#### WHAT IS THE PROBLEM?

Since the inception of the M-60A3 tank program in 1976, deliveries of fire control systems have not been sufficient to satisfy Army requirements for producing new tanks and for converting M-60A1 tanks to the A3 configuration. The problem became acute in December 1979 when deliveries of fire control systems were 362 less than the Army's requirements, and tanks could not be deployed to Europe as projected. The Army did not anticipate receiving sufficient numbers of fire control systems to satisfy its requirements until early in calendar year 1983 and, as discussed in chapter 3, future projected deliveries are uncertain. Estimated cumulative tank requirements and fire control system deliveries as of January 1980 are shown on the next page.



To cope with these fire control system delivery shortfalls, the Army, in February 1980, decided to

- continue producing new tanks according to schedule and to store them, to the extent necessary, until fire control systems become available and
- delay the start of the depot conversion program and to move forward tank conversions scheduled to begin in fiscal year 1984 under another program.

These decisions and the impact of the late deliveries of fire control systems are discussed below.

NEW PRODUCTION TANKS ARE STORED UNTIL FIRE CONTROL SYSTEMS BECOME AVAILABLE

Delays in fire control system deliveries have resulted in the Army storing 888 newly produced tanks and in the Army delaying tank deployments which has affected the readiness of U.S. forces in Europe. The storage of tanks will also result in additional production costs of about \$5.8 million.

As of May 30, 1980, 1,035 complete and incomplete tanks had been produced. Of these tanks, 888 or 86 percent were

stored--480 are still in storage. The picture on page 9, taken in the fall of 1979, shows about 100 tanks in storage or about 380 fewer tanks than are currently stored. The investment value of the 480 tanks, which represents about 4 percent of the Army's total tank inventory, is about \$300 million. The table below summarizes the status of tank storage.

M-60A3 Tank Status  
as of May 30, 1980

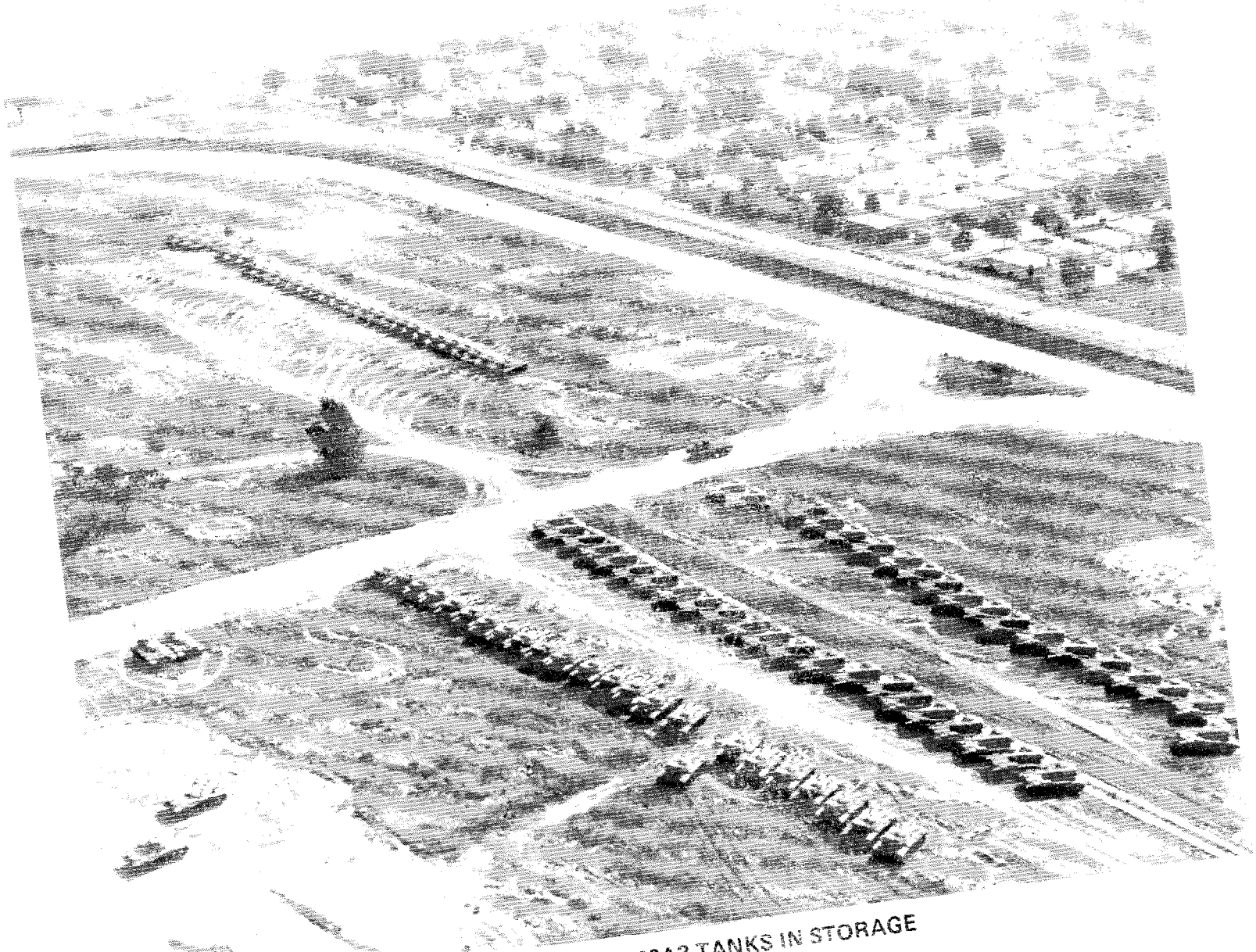
<u>Description</u>	<u>To storage</u>	<u>From storage (completed and shipped)</u>	<u>Tanks in storage</u>
Tanks without laser range-finders (note a)	553	408	145
Tanks without fire control systems (note a)	<u>335</u>	<u>-</u>	<u>335</u>
Total	<u>888</u>	<u>408</u>	<u>480</u>

a/The Army classified tanks without laser rangefinders as tanks in temporary storage. Tanks without fire control systems were classified as long-term storage.

Storage of incomplete tanks  
increases production costs

The Army has incurred and will incur additional costs of about \$5.8 million to preserve and complete the production of stored tanks. These costs are necessary to (1) prevent deterioration of the stored tanks (preservation), (2) reintroduce the stored tanks into the production process, (3) install laser rangefinders in tanks not reentering the production process, and (4) purchase security devices. A breakdown of these extra costs is shown below.

<u>Nature of cost</u>	<u>Total cost increase</u>
Preservation	\$1,623,000
Reintroduction of tanks into the production process	3,675,000
Installing rangefinders in tanks not reentering the production process	468,000
Security devices	<u>9,000</u>
Total	<u>\$5,775,000</u>



COURTESY OF THE U.S. ARMY

INCOMPLETE M-60A3 TANKS IN STORAGE

The preservation cost includes preparing a tank for storage, periodically inspecting and operating it while in storage, and deprocessing it to remove it from storage. An additional cost is also incurred when tanks are reintroduced into the production process. In the normal production process, the tank's turret is joined with the tank close to the end of the process. However, due to shortages of fire control systems, the turret was joined with the incomplete tank before the tank was stored. Later, the turret was removed from the tank when it was reintroduced into production and joined again to complete assembly. In summary, an extra installation and removal of the turret occurred when the fire control system was installed which resulted in extra costs.

Also, extra costs will be incurred for installing laser rangefinders and for other work.

#### Impact of stored tanks on readiness

The storage of tanks has delayed the Army from deploying M-60A3s to our forces in Europe. The Army has stated that the M-60A3 has a much greater first round hit capability than its predecessors because of the improved fire control system. Since 480 new tanks are in storage, representing about 8 tank battalions, the readiness of the Army has been impaired. Also, late deliveries of fire control systems have delayed conversion of M-60A1 tanks to the A3 configuration. This delay further impairs readiness.

#### SUBSTITUTION OF ANOTHER CONVERSION PROGRAM FOR THE M-60A3 PROGRAM

The shortfall of fire control systems not only affected new production, but it also delayed the conversion of M-60A1 tanks to the A3 configuration. Foreign military sales have also compounded this delay.

As a result of this shortfall, the depot conversion program has slipped. In fiscal year 1980, 137 conversions were to be accomplished--2 at the Mainz depot and the rest at the Anniston depot--while in fiscal year 1981, an additional 390 M-60A1 tanks were to be converted--126 at Mainz and 264 at Anniston. <sup>1/</sup> According to Army officials, only two tanks will be converted in fiscal year 1980. Twenty-seven tanks are scheduled for conversion in fiscal year 1981.

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<sup>1/</sup>The fiscal year 1981 Army budget showed 448 M-60A3 tank conversions. While 448 tanks were to be inducted into the conversion program, only 390 were expected to be completed during the fiscal year.

The slippage in the M-60A3 conversion program will reduce the available workload at the two depots. Army data indicate that Anniston's workload will be reduced by 110 staff-years in fiscal year 1980 and by about 192 staffyears in fiscal year 1981. At Mainz, the workload will not be reduced in fiscal year 1980, but it will be reduced by about 170 staff-years in fiscal year 1981. To minimize the impact of such reductions at Anniston, the Army substituted tanks from the M-60A1 RISE PASSIVE program scheduled for conversion in fiscal year 1984. 1/ The M-60A1 RISE PASSIVE tank is an improved version of the M-60A1 tank and represents the configuration immediately preceding the M-60A3 tank.

Using a rough estimate of the number of staffyears necessary to perform a RISE PASSIVE versus an M-60A3 conversion, the Army projected that Anniston's workload would be reduced by 38 staffyears in fiscal year 1980 and 65 staffyears in fiscal year 1981. Army officials considered these workloads as manageable (i.e., able to be handled through normal attrition). Although these estimates were based partly on data contained in a work measurement system and a recent Army Audit Agency report 2/ questioned the reliability of this data, our analysis indicated that the errors contained in Anniston's system were not large enough to make an appreciable difference.

The delays have also affected readiness of U.S. forces. To illustrate, delays in the fiscal year 1981 conversion program at Mainz of 126 tanks--representing about 2 tank battalions--will result in deployment slippages for these 2 battalions.

#### OTHER ALTERNATIVES CONSIDERED BY THE ARMY

In arriving at its course of action dealing with fire control system delivery delays, the Army considered and rejected several alternatives. The first alternative was to leave the program as it was structured. Army officials rejected this alternative because it would have caused depots to store incomplete converted tanks and to have asset generation problems; that is, units in the field would not release tanks to the depots unless the units were assured of substitutes.

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1/The Army could not provide a similar substitution program for Mainz.

2/Report of Audit, Depot Maintenance, Anniston Army Depot, SO 80-8, February 1, 1980.

The second alternative was to assign available fire control systems first to new tanks in storage and the remainder to the M-60A3 depot conversion depot conversion program, while changing production at the Detroit Arsenal Tank Plant from M-60A3 production to M-60A1 RISE PASSIVE production. Army officials stated that this course of action was not feasible, in part, because:

--Apart from laser rangefinders and solid state computers, other fire control components necessary for bringing tanks out of storage were in short supply.

--Components necessary for producing RISE PASSIVE tanks at the tank plant were unavailable.

We examined the inventory and procurement status of components peculiar to the RISE PASSIVE tank and found the Army would need to procure some components for RISE PASSIVE production and leadtimes were up to 1 year. Since production of new tanks was scheduled to continue for another 2 years, the Army decided that this alternative was not cost effective and would not result in deploying more tanks.

A third alternative was to convert stored tanks from the A3 to the RISE PASSIVE configuration. This alternative would have involved stripping the A3 tank turrets of all components and then installing the necessary fire control components, bracketry, and electrical systems peculiar to the M-60A1 RISE PASSIVE tank. The Army estimated that this conversion would cost \$125,000 per tank and would require about 6 to 8 weeks. However, it would have been necessary to procure certain fire control components which require 1 year leadtime. Therefore, the first deliveries of converted tanks would have required about 15 months and this, again, would not have resulted in deploying more tanks.

#### CONCLUSION

Late deliveries of fire control systems have affected and will continue to adversely affect the M-60A3 program. These late deliveries have (1) caused the Army to store hundreds of tanks at additional costs and (2) delayed the Army from converting M-60A1 tanks to the A3 configuration at its depots, thereby reducing depot workloads. These problems delay readiness improvements since they cause the deployment of tanks to Army forces in Europe to slip.



### CHAPTER 3

#### FUTURE DELIVERIES OF M-60A3

##### FIRE CONTROL SYSTEMS ARE UNCERTAIN

The deliveries of fire control systems did not agree with the Army's projected M-60A3 deployment and conversion program schedules. The Army has periodically revised these schedules because of slippages in fire control system deliveries. Using a fire control system delivery forecast made in January 1980, the Army revised its tank deployment and conversion program schedules. These schedules may slip even further because of a new fire control system forecast made in April 1980. Even this forecast may be optimistic because of continuing production problems. Additional requirements for fire control systems for foreign military sales may cause further deployment and conversion program slippages.

##### DELIVERY PROJECTIONS HAVE BEEN AND MAY STILL BE TOO OPTIMISTIC

The projections of fire control system deliveries have changed periodically over the last 3 years. As a result, the Army has changed periodically its M-60A3 tank deployment and conversion program schedules. Unless delivery projections become more realistic, the Army may incur further slippages in its deployment and conversion schedules.

The Army's critical need for tanks influenced the original forecast (September 1976) of fire control system deliveries. To meet the Army's timetable for fielding (deploying) M-60A3 tanks, Hughes had to begin delivering systems 13 months after the contract award was made.

Both Hughes and Kollsman have had difficulties in meeting their scheduled delivery dates. Hughes first informed the Army of its difficulty in meeting the delivery dates in December 1977. Between December 1977 and May 1979, Hughes made several more changes to its delivery schedules. Similarly, Kollsman's schedule also slipped. By May 1979 the total slippage of fire control systems from the original schedule amounted to 268 systems. As a result, the Army stopped relying on contractor estimates and made its own forecast of both Hughes and Kollsman deliveries. Between May 1979 and January 1980, the Army made two more revisions to its forecast.

Finally, in January 1980 the Army developed a forecast which it believed would require few revisions, if any. The Army based its deployment and conversion schedules on this

forecast. However, since then, the Army has revised the forecast in anticipation of further delivery slippages. As discussed on page 18, this change, in turn, could affect the latest M-60A3 deployment and conversion schedules.

Army officials are aware that past contractor forecasts of fire control system deliveries have not been realistic. They attribute the unrealistic forecasts to unforeseen problems resulting from the vendors' deliveries, the production procedures, and the technical data package used to produce fire control systems, as well as overoptimism on the part of the contractors regarding their capability to deliver systems. However, they believe that their April forecast is more realistic than past projections because (1) the technical data package has been approved, (2) Hughes has been producing fire control systems close to the projected rate for several months, and (3) problems, such as material availability, appear to have been improved. Whether the contractors can meet the Army's projected deliveries is still uncertain. Contractors may still not be able to meet their new schedules since:

- The fire control system design is not yet firm.
- Kollsman has not yet demonstrated its capability to produce systems in quantity.
- The technical data flow needs improvement.

Fire control system design  
is not free from change

Engineering Change Orders may be submitted either by the Government or by the contractor to revise a system design. These changes allow the Government the flexibility to revise contracts, as well as allow the contractor to correct design deficiencies. The frequency of system design changes may be one indicator of whether or not the technical data package necessary for the production of the system is adequate. Hughes has made frequent changes to the design of the fire control system. Although Hughes has tried to reduce the frequency of the changes, it still continues to submit numerous changes. The large number of changes has had and may continue to adversely affect both Hughes and Kollsman in meeting their scheduled deliveries.

To develop the technical data package necessary to produce the fire control system, Hughes submitted, and the Government approved, over 3,000 change orders. Hughes officials stated that this large number of changes contributed significantly to the delays they had experienced in producing

fire control systems. However, they were unable to provide specific information concerning the extent to which fire control system delivery delays were caused by these changes.

Kollsman, as the follower contractor, has no responsibility for system design and most of the engineering changes submitted by Hughes must be incorporated into the follower's contract. The Army acknowledged that it awarded the follower contract to Kollsman before Hughes had finalized a design suitable to produce the quantity of systems needed. Kollsman has experienced significant delays in system deliveries due to incorporating Hughes' changes. For example, both the Army and Kollsman agreed that the initial delay which occurred from December 1978 to May 1979--by which time Kollsman should have delivered 50 systems--was caused because Kollsman had to incorporate the first 1,099 changes into its system design. Although neither the Army nor Kollsman knew the extent to which the remaining changes had delayed Kollsman's subsequent system deliveries, they thought it was significant.

The situation is further complicated by the fact that the Army did not require Kollsman to incorporate all changes submitted by Hughes into all of its fire control systems. Army officials stated that this was done to maximize the delivery of fire control systems from Kollsman. While this may have been a proper management decision, it has resulted in Kollsman producing three different versions of the fire control system. An Army study <sup>1/</sup> pointed out that supply support for maintaining the three different versions may be a problem, since parts for the third configuration may not fit earlier configurations.

Kollsman has not demonstrated its capability to produce systems in quantity

Kollsman's original contract required it to deliver 425 systems by February 1980. However, as of that date, Kollsman had not delivered any systems. The first three systems were scheduled to be delivered in May 1980. In January 1980, the Army reviewed the contractor's production facilities, equipment, and management systems. The Army concluded that a number of improvements were needed in each of the above areas. We later visited these facilities and found that improvements had been made. However, we believe Kollsman's ability to meet its schedule will be significantly affected by

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<sup>1/</sup>This study was performed by the U.S. Army Materiel Development and Readiness Command on January 12, 1980.

--whether its systems will pass their performance tests and whether its test equipment is adequate and

--whether all necessary engineering changes have been made to its design.

#### Testing of Kollsman systems

Each of the major fire control system components, including the laser rangefinder and the solid state computer, must undergo a series of performance tests to determine whether the components meet the required specifications for acceptance by the Government. Sufficient testing has not been done to identify all potential problem areas. Test equipment shortages can also limit Kollsman's systems deliveries.

According to Kollsman officials, the company must achieve an 80 to 90 percent success rate (yield rate in the tests) to meet the April 1980 forecast. Although Kollsman officials were optimistic concerning the future yield rates, the rate on an initial acceptance test for the solid state computer was less than 15 percent. For example, one computer has been tested five times, but it has yet to pass.

Furthermore, the lack of sufficient test equipment could reduce Kollsman's ability to deliver fire control systems. One contractor official estimated that Kollsman could deliver only 35 to 40 systems a month because of this limitation. Kollsman is aware that test equipment will become a bottleneck when it is to produce 50 systems a month. Kollsman is studying this limitation so that it can recommend a solution to the Army. Kollsman believes that it will need about 6 months to increase its acceptance testing capability once the Army approves the acquisition of additional test equipment.

#### Adequacy of system design

An adequate technical data package is necessary for the production of fire control systems. The Army study, previously mentioned, stated that Kollsman's technical data package might not be adequate. Specifically, the study noted that Kollsman may not have incorporated all Hughes' changes into the technical data package. The study recommended that the Army and the contractor identify all critical changes which have not been incorporated.

Army, Hughes, and Kollsman officials believe that all critical changes have been incorporated into the system design. However, the adequacy of the design cannot be verified until

Kollsman's systems pass all their performance tests. During our April 1980 visit to Kollsman, we noted that none of the systems had passed all of these tests. After our fieldwork had been completed, Army officials told us that three systems had passed the initial tests needed for acceptance by the Government by April 1980.

TECHNICAL INFORMATION  
PROVIDED TO KOLLSMAN

Under the leader-follower procurement concept, the follower contractor cannot produce acceptable systems without the timely receipt of complete technical data. Kollsman, as the follower contractor, has experienced difficulties in obtaining the needed technical data from the Army and from Hughes. The receipt of insufficient data could further delay Kollsman's system deliveries.

Kollsman produces its systems based on the technical data package developed by Hughes. Kollsman receives technical assistance from the Army and Hughes through a technical assistance contract.

The Army study identified several problems in the information and assistance provided by the Army and Hughes' to Kollsman. These problems included:

- The Army was taking longer than necessary to contractually authorize incorporation of Hughes changes.
- Kollsman was not always readily made aware of solutions to Hughes' engineering problems which could affect the production of fire control systems.
- The reasons for incorporating Hughes' changes into Kollsman's system design were not well documented.

Kollsman officials informed us that these problems have not been resolved. They believe their primary difficulty was in obtaining timely resolution to technical problems. They attributed this difficulty to

- delays of up to 1 year in receiving critical Hughes' changes and
- the inability of the Army to provide all needed direct assistance.

DELIVERY SLIPPAGES MAY CAUSE FURTHER DELAYS  
IN THE ARMY'S M-60A3 TANK CONVERSION PROGRAM

The Army has revised periodically its M-60A3 tank program to reflect the changes in fire control system delivery schedules. The latest projection appears too optimistic because of continuing technical and procurement problems at contractor plants. As discussed below, the Army's conversion program may slip by as much as 11 months because of these problems.

Under the April 1980 projection, the Army expects Hughes to build up to and to sustain a production rate of 49 systems a month by June 1980. Similarly, the Army expects Kollsman to build up to 50 systems a month by February 1981. At these rates, the Army will "get-well" by June 1981 at which time cumulative fire control systems will equal Army requirements.

By comparison, if total contractor deliveries were 80 units a month--a rate which Army officials believed could be achieved with a high degree of certainty--the get-well date would be extended from June 1981 to May 1982, representing an additional 11-month delay to the conversion program. The delay is equivalent to equipping about four tank battalions 1/ for deployment. A chart showing the get-well date at this rate, as well as at currently projected rates, is shown in appendix I.

Foreign military sales of M-60A3 tanks will also extend the get-well date and, consequently, delay the conversion program. The Army has officially agreed to sell 494 tanks to three different countries.

Since the Army has given foreign military sales priority over the conversion program, the get-well date could slip by another 6 months (494 units divided by 80 a month) to about December 1982. The impact of foreign sales on the depot conversion program is discussed in the next chapter.

CONCLUSIONS

Uncertainties in the deliveries of the fire control systems may continue to delay completion of the Army's deployment and conversion program. These uncertainties are due partly to (1) Hughes still submitting design changes which must be incorporated into the technical data package Kollsman uses

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1/A tank battalion generally represents 54 tanks.

to produce its systems and (2) Kollsman having not yet demonstrated that it can produce systems in needed quantities. These uncertainties, coupled with the fact that Hughes has not consistently produced fire control systems at currently projected rates, may further delay the completion of the Army's tank deployment and conversion program by as much as 11 months.

## CHAPTER 4

### SALES TO FOREIGN GOVERNMENTS REDUCE

#### READINESS OF U.S. FORCES AND COMBAT VEHICLE

##### DEPOT WORKLOADS

In allocating fire control systems to the tank production and conversion programs, the Army gave priority to satisfying production requirements that included foreign sales orders, as well as its own needs. Foreign sales, therefore, were a factor in delaying the start of the tank conversion program at the Mainz and Anniston Army depots which, in turn, caused slips in deploying M-60A3 tanks and delays in improving readiness of U.S. forces. In addition, slippage in the conversion program has contributed to the steadily declining workload at Anniston, thereby increasing the risk that any future workload reductions cannot be accommodated by staff reductions through attrition. Such staff reductions at Anniston could decrease the depot's ability to accommodate any surge in tank maintenance requirements that could occur during a national emergency.

The International Security Assistance and Arms Export Control Act of 1976 (P.L. 94-329) states that sales to foreign governments should be kept to an absolute minimum if such sales have a significant adverse impact on combat readiness of U.S. forces, but the law does not define what constitutes a significant adverse impact.

The following sections discuss delays in the depot conversion program, impact of the delays on readiness, and possible options available to the Army to reduce the impact of foreign sales.

##### SALES TO FOREIGN GOVERNMENTS WILL DELAY THE M-60A3 CONVERSION PROGRAM

The Army has delayed the start of its M-60A3 depot conversion program by about 15 months so that it could satisfy production requirements for tanks to be sold to foreign governments, as well as for its own forces.

The Army allocated 708 fire control systems to foreign governments before establishing the date on which its own conversion program could begin. Of the 708 systems, 250 were for two firm foreign government orders and 458 systems for potential foreign government orders in calendar year 1982. The Army later finalized another sales order for order for 244



M-60A3 tanks. While these tanks are scheduled to be produced in calendar year 1982, the Army plans to fill part of this order in December 1980 by diverting 64 tanks from its inventory.

The conversion program was scheduled to begin at the Anniston depot in January 1980 and at the Mainz depot in October 1980. Because there were slippages in deliveries, available fire control systems were first assigned to new tank production. As a result, the start of the conversion program was delayed. Further delays in the conversion program occurred because systems were assigned to foreign military sales before they were assigned to the conversion program. Also, the completion dates of the conversion program were changed. The Anniston program is now scheduled for completion in early fiscal year 1986 as opposed to mid-fiscal year 1985. The Mainz completion date was changed from late fiscal year 1983 to late fiscal year 1984.

Army officials believe certain benefits will be derived from these foreign sales orders. According to these officials, foreign military sales orders for M-60A3 tanks allow the Army to maintain a warm tank production base when U.S. Army requirements cannot support continued production at the tank plant and supporting foundries. They said that until the Army achieves volume production of XM-1 tanks, the M-60A3 production base is of strategic importance to the United States. Furthermore, they stated, the absence of foreign sales orders would require only one fire control system producer. However, with foreign sales orders, two producers are needed which allows the Army, in the near term, to get fire control systems more quickly while getting back on schedule.

DELAYS IN THE DEPOT CONVERSION  
PROGRAM ADVERSELY AFFECT  
READINESS AND DEPOT WORKLOADS

The Army has firm orders for 494 M-60A3 tanks, and it plans to deliver these tanks to foreign governments before all U.S. requirements--production and conversion--are satisfied. These tanks are equivalent to about 43 percent of the Army's projected inventory of M-60A3 tanks as of December 1980, when deliveries of these tanks are scheduled to begin. Therefore, the conversion program will be delayed because the Army will allocate fire control systems to the 494 tanks before it allocates systems to the depots for the conversion program. The priority given to the 494 tanks, which is equivalent to 9 tank battalions, will delay the start of the depot conversion program by about 6 months. This, in turn, will delay deployment of these tanks by an equivalent period until the end of the conversion program in fiscal year 1986.

Another issue affecting readiness involves the ability of depots to "surge" during times of national emergency; that is, to expand as rapidly as possible to satisfy initial emergency requirements. The ability of a depot to expand rapidly depends largely on maintaining a properly sized and skilled workforce. The size and skill of the workforce, in turn, depends on the level and composition of the workload. However, it may be difficult to maintain proper workload levels in the combat vehicle commodity group at the Anniston depot.

According to Army officials, Anniston's combat vehicle workload has been steadily declining and this trend will continue to about fiscal year 1985, with no additional combat vehicle workload foreseen. <sup>1/</sup> This workload decline is due partly to (1) the late delivery of fire control systems and (2) the priority given to firm and potential foreign government M-60A3 sales over the depot conversion program. Workload declines through fiscal year 1981 attributable to delays in the M-60A3 conversion program will be compensated for largely by the Army's decision to move forward the M-60A1 RISE PASSIVE conversion program. However, Army officials stated that any workload declines beyond the early part of fiscal year 1982 would create problems for Anniston. Specifically, they said that currently projected workload declines through 1981 could be handled through workforce attrition, but any additional declines would have to be handled through other means. As discussed in chapter 3, such workload declines could arise from additional M-60A3 sales to foreign governments or from further delays in fire control system deliveries.

Should these additional workload declines occur, the Army may have to reduce the Anniston depot workforce to a level where the depot's ability to respond promptly during national emergencies is affected. Even today there is a question regarding the depot's ability to respond to a national emergency. In a recently completed review of Army combat vehicle depots, we noted that depots could not accommodate a substantial portion of workload assigned to them during the first 6 months of an emergency. However, options are available to partially alleviate the readiness problems generated by possible workload reductions.

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<sup>1/</sup>We requested combat vehicle workload trends for Anniston for fiscal years 1977 through 1985. However, we did not receive this information before our fieldwork was completed in May 1980.

POSSIBLE OPTIONS AVAILABLE  
TO REDUCE IMPACT OF FOREIGN SALES

Two options that may be available to free fire control systems currently assigned to foreign sales orders are (1) to delay deliveries and (2) to change the tank configuration. Implementation of either of these options should enable the Army to start and complete its tank conversion program sooner.

The first option delays the delivery of M-60A3 tanks to foreign governments until sufficient fire control systems are available to satisfy the depot conversion program. Under this option, the Army will store tanks without fire control systems for foreign governments, which is similar to what the Army is doing with its new tanks. As sufficient systems become available, these tanks will be reintroduced into the production process for completion.

Army officials agreed that this option could work. They stated that foreign sales tanks could be stored at the Detroit Arsenal Tank Plant and returned to production since the line would still be available to complete the production process. They further agreed that even if the M-60A3 production line no longer existed, the stored tanks could be shipped to the Anniston Army depot for completion.

Another option is to furnish foreign governments with the M-60A1 RISE PASSIVE tank. While this tank is not the most modern one, it is the immediate predecessor to the M-60A3 tank. Many components comprising the fire control system of the M-60A1 RISE PASSIVE tank differ from those of the M-60A3 and would have to be procured. According to Army officials, the procurement leadtime for these components would be about 1 year. They commented that this leadtime would present no problem since the production of tanks for foreign orders is still over 1 year away. Further, they noted, foreign governments could convert M-60A1 RISE PASSIVE tanks to the A3 configuration at a later date.

CONCLUSIONS

Sales of 494 M-60A3 tanks to foreign governments will affect the readiness of U.S. forces because such sales can delay the deployment of about 9 tank battalions for more than 1 year. Also, foreign sales will delay the M-60A3 depot conversion program because the Army gave higher priority to assigning fire control systems to new tank production earmarked for foreign sales.

Since the conversion program slippage has contributed, in part, to the steadily declining workload at Anniston,

any future delays in the deliveries of fire control systems may require personnel actions over and above attrition. Any such personnel action will decrease the depot's ability to meet rapid increases in tank maintenance requirements which could be expected to occur during a national emergency.

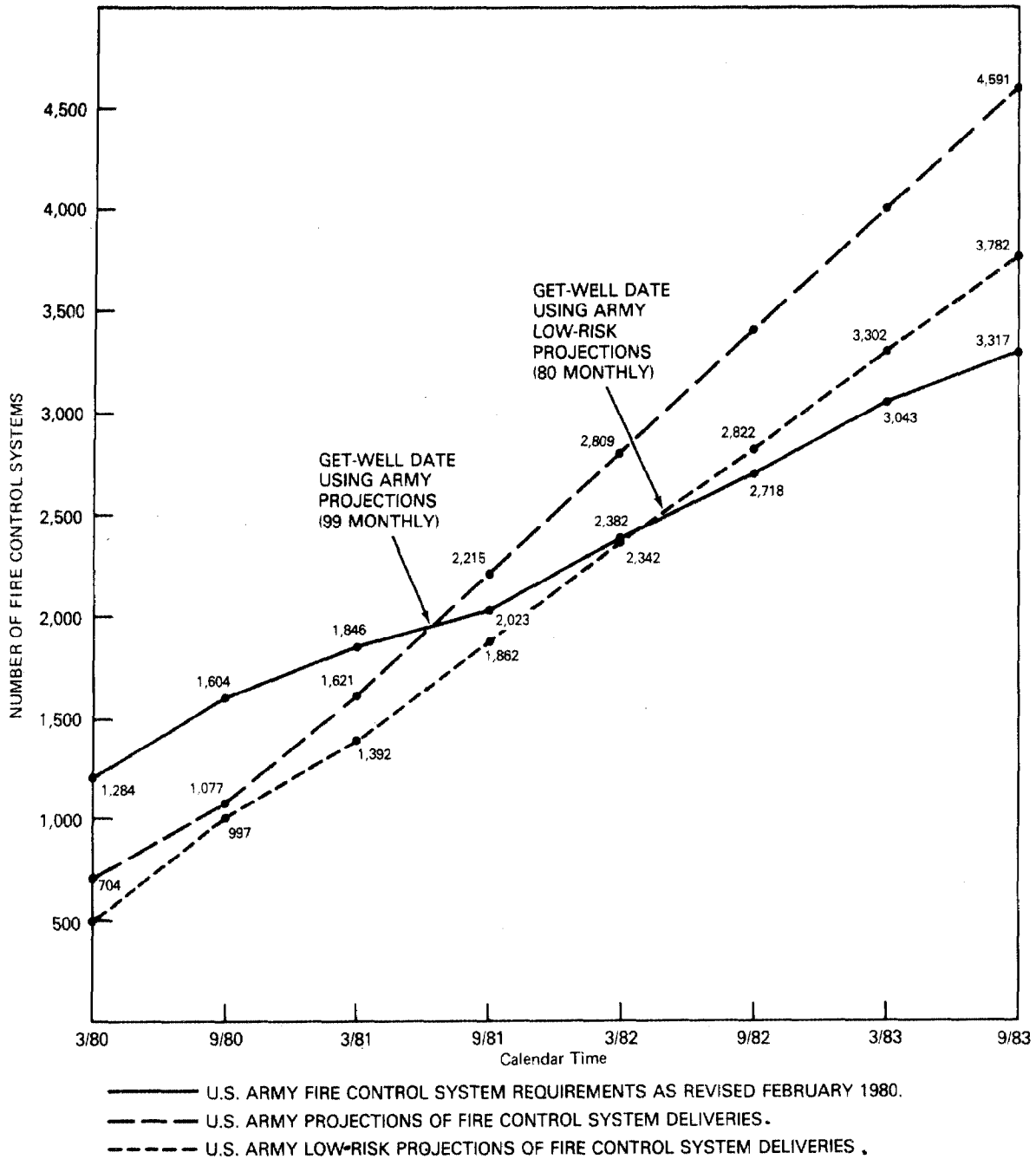
Two possible options to reduce the impact of foreign sales are (1) to delay M-60A3 tank deliveries to foreign governments and (2) to furnish foreign governments with the M-60A1 RISE PASSIVE tank. Implementation of either option should enable the Army to start and complete its conversion program sooner. However, both options require renegotiation of the foreign sales agreements.

MATTERS FOR CONSIDERATION  
BY THE COMMITTEE

The Committee should obtain the views of the Department of Defense and the Army concerning:

- The impact of the M-60A3 tank sales to foreign governments on the combat readiness of U.S. forces and the short and long-term impact on Army depot workloads.
- The feasibility of (1) delaying the delivery of the M-60A3 tanks to foreign governments until sufficient fire control systems are available to satisfy the depot conversion program and (2) furnishing foreign governments with earlier versions of the M-60 tank series.

**CUMULATIVE U.S. ARMY FIRE CONTROL SYSTEM REQUIREMENTS  
VERSUS PROJECTED DELIVERIES**



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