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The process the Army used to select Lima, Ohio, as the production site for its new main battle tank, the XM-1, was thorough, unbiased, and sound. Findings/Conclusions: The Army first obtained site studies from the potential producers of the XM-1 tanks, validated the studies, and then reviewed the data along with that provided by the Army Corps of Engineers. The Army's site selection process was, in turn, evaluated by an outside consultant. Finally, non-Government representatives analyzed and assessed the alternative sites. The decision to produce the XM-1 in Lima is sound based on the following assumptions: that there is a valid requirement for 3,312 XM-1 tanks; that the XM-1 full-scale engineering development phase will be a success; that production of the M-60 tanks must continue, without interference, through 1981; and that the first XM-1s must be delivered in February 1980. If the assumptions change, production of M-60 and XM-1 tanks at the Detroit, Michigan, plant could be feasible. Despite changes occurring in the XM-1 development, delaying site selection until the Army gets more information about the XM-1 is not essential. If site selection were delayed, the initial delivery date would be missed because preparing a tank factory is a lengthy process. (Author/SC)

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# *REPORT OF THE COMPTROLLER GENERAL OF THE UNITED STATES*

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## Selecting Production Site For Army's New Main Battle Tank

Department of Defense

The Army's selection of the Lima, Ohio, facility for its initial XM-1 tank production site was made after extensive studies, and in GAO's opinion, the decision was sound based on the Army's assumptions. The key assumptions were

- a need for 3,312 XM-1 tanks,
- success of the XM-1 full-scale engineering phase,
- maintenance of the M-60 tank production base and actual production through 1981, and
- first delivery of XM-1 tanks by February 1980.



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

B-163058

Lucien N. Nedzi and the  
Michigan Delegation  
Charles A. Vanik  
House of Representatives  
J. Bennett Johnston  
United States Senate

This report, prepared in reply to your requests, summarizes how the Army selected the initial production site for the XM-1 main battle tank.

Copies of the report are being sent to the Vice President of the United States; the other members of the Ohio congressional delegation; Representative Joseph M. McDade of Pennsylvania; the Governor of Michigan; the Ohio mayors of Brookpark, Conneaut, Cuyahoga Heights, Euclid, Garfield Heights, Highland Heights, North Royalton, Parma, and Woodmere; the Secretary of Defense; and the Secretary of the Army.

A handwritten signature in black ink, reading "Thomas R. Staals".

Comptroller General  
of the United States

D I G E S T

The process the Army used to select Lima, Ohio, as the production site for its new main battle tank, the XM-1, was thorough, unbiased, and sound. The Army first obtained site studies from the potential producers of the XM-1 tanks, validated the studies, and then reviewed the data along with that provided by the Army Corps of Engineers. The Army's site selection process was, in turn, evaluated by an outside consultant. Finally, non-Government representatives analyzed and assessed the alternative sites.

HISTORY

With the selection--on November 12, 1976--of the Chrysler Corporation's model for the XM-1, the program entered into its full-scale engineering development phase. During this 36-month phase, 11 tanks will be built and tested.

Assuming success in the full-scale engineering development phase, the production phase will begin in early 1980, and 3,312 tanks will be built. Initial, limited production will be at the Lima Army Modification Center; but, after the current M-60 series tank is phased out, the Army wants to produce the XM-1 also at the U.S. Army Tank Plant in Warren, Michigan (Detroit plant).

The key factor in considering the various production alternatives available to the Army is the quantity of tanks needed and the urgency of the need. The XM-1 is a main battle tank being developed by the Army to supplement and eventually replace M-60 series tanks. The XM-1 is better designed and is considered by the Army to be essential to counter the advantage of the Warsaw Pact Forces (i.e., about 26,250 tanks compared to

NATO's 10,500). The Army had about 8,600 serviceable tanks as of December 1976 and needed 16,749--3,312 XM-1s and the rest, M-60s. (See p. 1.)

Army officials consider the XM-1 essential for meeting the enemy tank threat and insuring the survival of our Army on any battlefield of the 1980s. Critics of the XM-1 question the premise that tanks are essential to provide firepower support for ground forces and think the tank may be obsolete. These and other related issues have been discussed in hearings before the House and Senate Armed Services Committees and the House and Senate Appropriations Committees for several years. In view of the consideration already given to this question, this review did not evaluate the need for the XM-1 tank. (See p. 1.)

#### THE SELECTION PROCESS

The decision to produce the XM-1 in Lima and GAO's conclusion that the decision is sound are based on the following assumptions:

- There is a valid requirement for 3,312 XM-1 tanks.
- The XM-1 full-scale engineering development phase will be a success.
- Production of the M-60 tanks must continue, without interference, through 1981.
- The first XM-1s must be delivered in February 1980.

However, if the assumptions change, production of M-60 and XM-1 tanks at the Detroit plant could be feasible. And, the Detroit plant could be the most economical production site depending on the changes made to M-60 and XM-1 production plans. (See pp. 28 and 29.)

A second tank production site was not a primary consideration in the site selection process and decision. The second tank plant was prompted

by the need to have manufacturing capacity highly responsive to unforeseen and fluctuating demands for tanks. (See p. 20.)

Despite the changes occurring in XM-1 development, delaying site selection until the Army gets more information about the XM-1--such as type of gun or engine--is not essential. General Motors and Chrysler Corporation officials said the major components (such as main gun and engine) are to be supplied by other manufacturers. Consequently, the uncertainty as to type of gun or engine did not affect the site selection decision. (See p. 14.) If site selection were delayed, the initial delivery date would be missed because preparing a tank factory is a lengthy process and may take up to 2-1/2 years. (See p. 29.)

Chrysler said it did not prefer one site over another. General Motors said it would prefer the Detroit tank plant if it were used only to produce XM-1s, otherwise it preferred the Lima plant. Both indicated that the Army's uncertainty as to which contractor would be selected probably had no effect on the Army's analyses. (See p. 14.)

The costs reviewed represent the Army's best future estimates and should not be considered as precise as historical accounting data. Total estimated costs of each alternative were appropriately applied. (See p. 6.)

GAO believes the Cleveland tank plant is less suitable than the Detroit and Lima plants for XM-1 production, primarily because of its structural limitations. (See p. 29.)

The Army concurred in GAO's findings and opinion. (See p. 48.)

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## CHAPTER 1

### IMPACT OF TANK REQUIREMENTS

#### ON SITE SELECTION PROCESS

To overcome shortcomings in the M-48 and M-60 series tanks, the Army is developing a new main battle tank, the XM-1. The XM-1 represents an improvement in tank design and is considered by the Army to be essential to counter the quantitative advantage of the Warsaw Pact. Two contractors, the Chrysler and General Motors Corporations, developed competitive prototypes.

#### EUROPEAN THREAT AND TANK REQUIREMENTS

Army officials consider the XM-1 essential for meeting the enemy tank threat and insuring the survival of our Army on any battlefield of the 1980s. Critics of the XM-1 question the premise that tanks are essential to provide fire-power support for ground forces and think the tank may be obsolete. These and other related issues have been discussed in hearings before the House and Senate Armed Services Committees and the House and Senate Appropriations Committees for several years. In view of the consideration already given to this question, we did not attempt to evaluate the need for the XM-1 tank.

According to a recent Congressional Research Service issue brief, the Warsaw Pact forces possess approximately 26,250 tanks, of which about 13,750 are provided by Soviet forces. This tank force is 2.5 times the size of NATO's (approximately 10,500). U.S. Army and Reserve components had about 6,600 prime tanks and 2,000 contingency tanks as of December 1976. To counter the threat of present Soviet tanks and more advanced tanks which U.S. Intelligence assumes the Soviets are developing, the Department of Defense decided to (1) replenish U.S. Army and Marine Corps inventories with improved M-60 series tanks, (2) convert old M-48A1/A3 tanks to the M-48A5 configuration (105-mm. gun and diesel engine), (3) complete the deployment of the vehicle-portable TOW and man-portable DRAGON antitank missiles, and (4) continue development of the XM-1. Under the plan the Army would have a mix of 3,312 high-cost XM-1s, 9,969 less expensive M-60s (7,875 M-60A1/A3s, 1,554 M-60s and 540 missile-firing M-60A2s), 1,894 M-48A5s, and 1,574 M-551s by December 1989. The Army's approximate proposed inventory objective for 1989 calls for 16,749 tanks.

Regarding the overall size of the U.S. tank force, procurement options are somewhat constrained because M-60 series tank production capacity is being fully utilized. This capacity is presently growing. The Army estimates that before January 1978, it will reach a peak of about 120 tanks a month. By the end of the fiscal year 1977 funded delivery period, the Army will have approximately 10,000 tanks, or about 70 percent of its requirements. For more details on the XM-1 design and development, see the reports referenced in appendix V.

#### SITE SELECTION PLANNING CRITERIA

The original XM-1 Tank System production plan, dated 1972, called for the manufacturing of the XM-1 at the U.S. Army Tank Plant, Warren, Michigan (Detroit tank plant) under the assumption that M-60 production would be phased out in 1976. But an unanticipated demand for M-60 series tanks, generated by the 1973 Middle East War, required M-60 series tank production to increase from 30 to over 100 a month and to extend planned production from 1976 to 1981.

As a result, the Department of the Army directed that the XM-1 Project Manager provide information necessary to make a site selection decision for the production of XM-1 tanks. As a result of that direction, a joint study group was formed and cochaired by the XM-1 and M-60 Project Managers; the joint group included representatives from the Army Tank-Automotive Command (whose current title is the Tank-Automotive Materiel Readiness Command).

By a November 14, 1975, message the Army directed that the objective of the XM-1 study group was to present production alternatives which would allow M-60 and XM-1 planned production on a peacetime basis, i.e., a 1-shift, 8-hour day, 5-day week. The Army imposed certain planning constraints so that the planning and cost development would be done in accordance with the XM-1 Tank System Development Plan. The following constraints were set:

- The M-60 mobilization base would be maintained until the XM-1 is in full production.
- M-60 production would continue through 1981.
- XM-1 production delivery would be initiated in October 1979.
- Fiscal year 1977 XM-1 facility funds would be limited to \$65.2 million.

--XM-1 capital investment would be limited to that needed for peacetime production plans.

The Army further specified that the alternatives developed should be adaptable so that the peacetime XM-1 production rate can be increased to 60 a month with a surge rate of 150 a month. A production rate of 60 tanks a month and a surge capacity of 150 a month was the Army's requirement imposed for (1) meeting planned peacetime production and (2) complying with Department of Defense guidance on capital investment. The Department's guidance stated that the size of newly constructed production facilities would generally allow the procurement of the total inventory objective within 5 years with a facility operating on a 1-shift, 8-hour, 5-day basis.

It is necessary to gain some familiarity with tank manufacturing and assembly processes to understand the relationship between the various site alternatives and their effect on tank production. These relationships are significant because the design characteristics of the XM-1 impose facility requirements that differ from those needed in M-60 production.

Tanks are heavily armored vehicles and are, therefore, particularly large and heavy. The XM-1 tank will weigh approximately 58 tons, exceeding the weight of the current M-60 series tank by about 5 tons. This weight imposes severe requirements on the physical plant, particularly on the size and floor weight-bearing and crane-lifting capacities.

The design of the XM-1 incorporates a welded hull and turret as opposed to the M-60 cast hull and turret supplied by vendors. As a result, more floor space is required for the welding, fabricating, and machining of hulls and turrets. In-plant fabrication and machining may help to hold down the unit cost of XM-1 tanks since this method is generally cheaper than purchasing from vendors.

The floor weight-bearing capacity needed to support the weight of the fully assembled XM-1 tank is about 1,800 pounds a square foot. Floors of lesser weight-bearing capacities can be used for light manufacturing processes, but the production design layout will unavoidably be influenced by the strength of the floors.

Also, because of the weight of the XM-1, cranes with lifting capacities of 10 to 60 tons are required. Cranes are indispensable since they provide an efficient means of transporting the tank and components. However, 10- to 60-ton cranes require heavy structural steel framework, solid foundations, and high bay areas.

Lastly, the production facility must have a test track. A test track about 1.8 miles long and capable of allowing tests at speeds up to 45 miles an hour is specifically required.

### SITE SELECTION PROCESS

To obtain cost and production data on potential manufacturing sites for the XM-1, the Army requested Chrysler and General Motors to submit site evaluation studies, including cost analyses, for preparing the Lima Army Modification Center (Lima plant) and the Detroit plant for XM-1 production. Each contractor was told to submit evaluations on other sites, both Government and privately owned, if their preliminary analysis showed significant economic advantages to the Government. In addition, the Army Corps of Engineers contracted with an engineering firm, H. K. Ferguson Inc., of Cleveland, Ohio, for a report on the cost of modernizing and expanding the Lima and Detroit plants under varying plant expansion alternatives. The M-60 Project Manager's Office supplied cost and capacity data concerning the possible termination and relocation of M-60 tank production.

### XM-1 study group

On the basis of the data inputs previously mentioned, the XM-1 study group made a cost analysis of six alternatives. The rationale of the XM-1 study group's report and its analyses were reviewed and concurred in by a consultant team from the Illinois Institute of Technology Research Institute. These alternatives considered use of the Detroit plant, Michigan Army Missile Plant, and the Lima plant. Full cost analyses were not made for other sites because no other site was considered to be economically advantageous following preliminary evaluations by General Motors and Chrysler. (See p. 25.) In an XM-1 site selection study report on December 24, 1975, the study group recommended that the Department of the Army select the Lima plant for XM-1 production. Chapter 2 presents the details of this group's work.

### Ad Hoc Committee

In March 1976 the Assistant Secretary of the Army (Installations & Logistics) established an Ad Hoc Committee, consisting of five representatives from the private sector, to provide him a further analysis and assessment of the alternative sites. The five representatives were: the former Executive Director of the Manufacturing Staff of Ford Motor Company; the Director of Capital Appropriations of

Eaton Corporation; the Director of Manufacturing, International Division of Rockwell International; Director of Facilities Planning of Deere & Company; and the former Manager of the East Peoria Plant of the Caterpillar Company. In April 1976 the Ad Hoc Committee endorsed the selection of the Lima plant for initial XM-1 production and recommended the future use of the Detroit plant for achieving a production rate of 60 tanks a month. Chapter 3 presents the details of this Committee's work.

### SITE SELECTION

In August 1976 the Secretary of the Army announced that the Lima plant had been selected as the production site for the XM-1 tank. The Secretary also stated that the Army selected the Detroit plant as a second production facility. According to the Secretary, the Army's plan is to establish an integrated production facility at Lima with a capacity sufficient for producing 30 tanks a month, which is one-half of the ultimate projected production requirement. The Secretary said use of the Detroit plant would be necessary later to expand capacity for meeting the desired production requirements. The Secretary's announcement noted that the Army later intended to request funds from the Congress for the conversion of the Detroit plant. The Detroit plant would be scheduled to begin XM-1 production as the current M-60 series production phases down in the early 1980s.

According to the Secretary, the selection of the Lima plant for initial production will permit the modernization and optimal production layout of an existing Government-owned plant for efficient, cost-effective production without interference with M-60 production in Detroit. The Secretary further stated that this plan would provide the maintenance of a crucial measure of defense readiness as the new tank is phased into the Army's tank fleet.

## CHAPTER 2

### XM-1 STUDY GROUP REPORT ON PRODUCTION SITES

The Army established an XM-1 study group to report on production alternatives for XM-1 tanks. Two sites, the Detroit plant and the Lima plant, were analyzed by the XM-1 study group under varying alternatives of production and expansion. The Lima plant, expanded by 500,000 square feet, was the recommended site. The following Army photographs depict the two plants. Figure 1 is an aerial view of the Detroit plant. Figure 2 is an aerial view of the Lima plant. Figures 3 and 5 are interior views of the Detroit plant, and figures 4 and 6 are interior views of the Lima plant when it was used as a modification center.

### SITE COSTS OF ALTERNATIVES

The costs of each alternative considered by the XM-1 study group are shown in the table on page 13. The costs represent the best estimates of Army engineers and should not be considered as having the precision of accounting data. Their primary usefulness is in establishing an order of magnitude for various alternatives.

The table on page 13 shows that the Detroit and Lima plants require considerable site preparation and production equipment acquisition. Notably, even though the Detroit plant is a tank-producing facility, the plant would still require a minimum investment of \$19.9 million for factory and site preparation to meet XM-1 production requirements. As a tank production facility, the Detroit plant already possesses a number of cranes and production equipment suitable for XM-1 production, thus a lesser investment for such equipment would be necessary if the Detroit plant were used.

In terms of factory, site, and equipment costs, the Lima alternatives appear to be more costly regardless of the degree of expansion. But, the M-60 and XM-1 program costs must also be considered. The M-60 program costs represent the costs of terminating and/or relocating M-60 production. These program cost changes appear only when the Detroit plant is considered as the XM-1 production site. The XM-1 program costs increase at Lima as the amount of production space is reduced. The increases occur primarily because a smaller facility requires more purchasing from outside sources and generally at a higher cost than the making of in-plant parts.



FIGURE 1 DETROIT TANK PLANT



FIGURE 2 LIMA ARMY MODIFICATION CENTER



FIGURE 3 DETROIT TANK PLANT

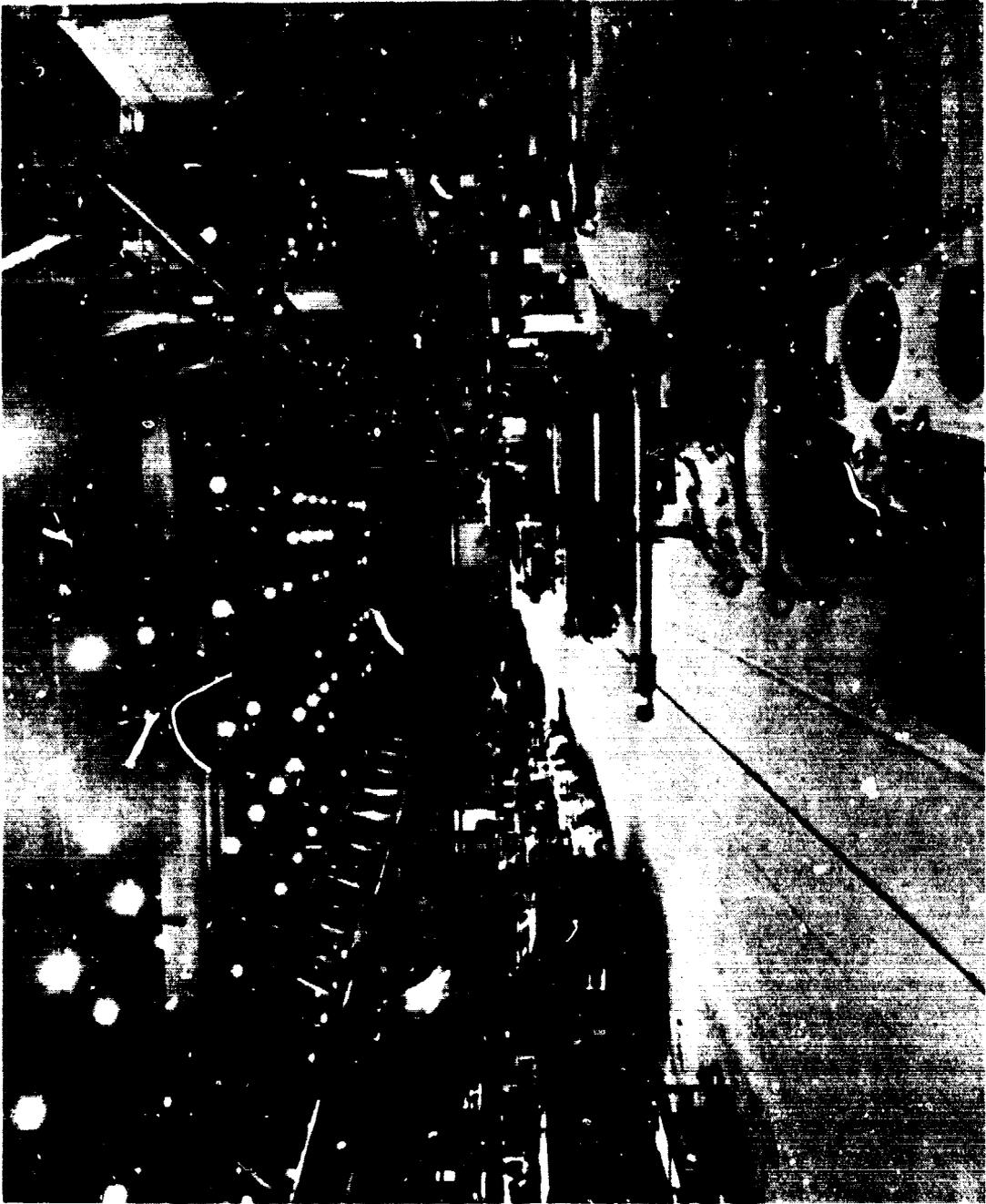


FIGURE 4 LIMA ARMY MODIFICATION CENTER

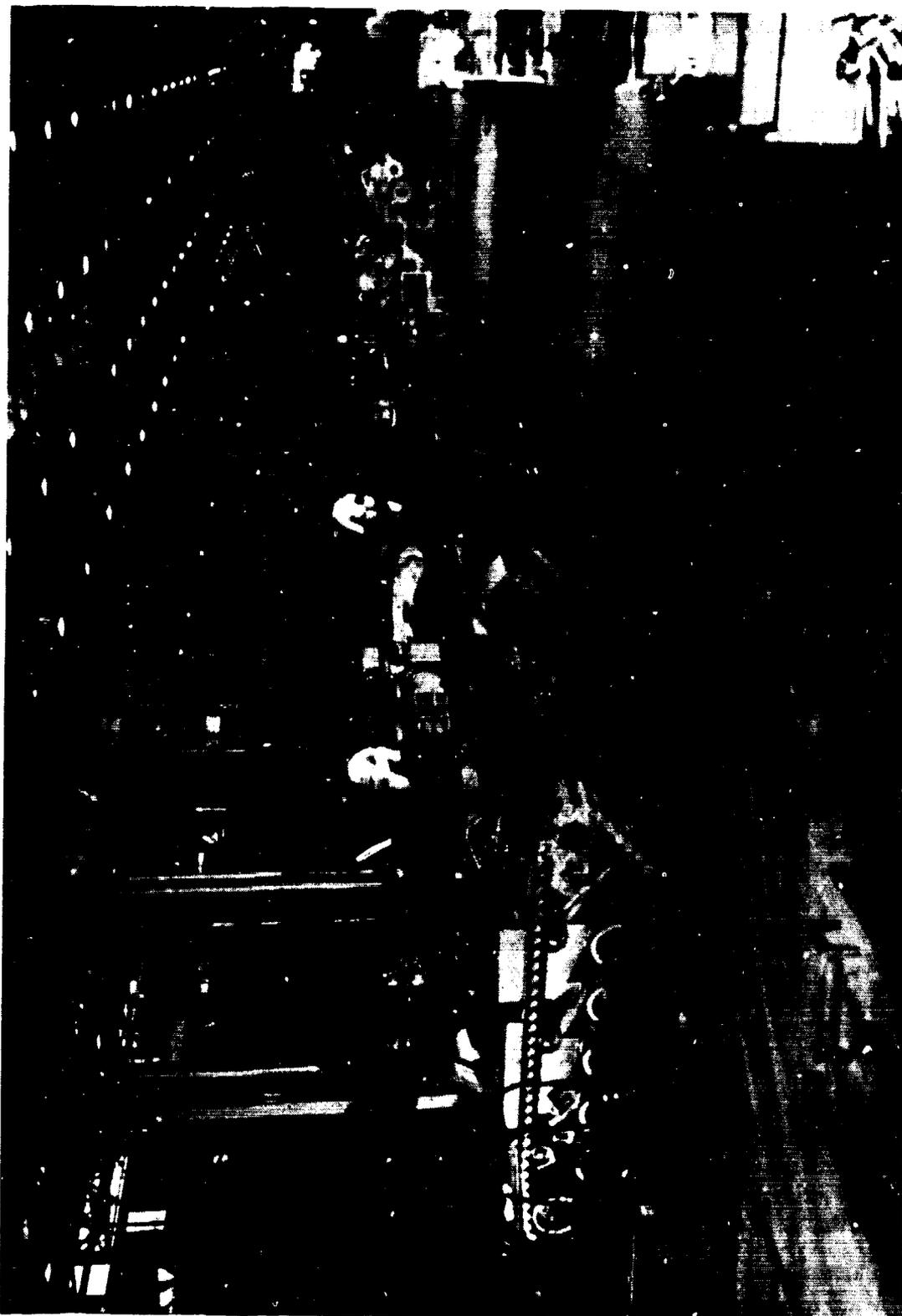


FIGURE 5 DETROIT TANK PLANT

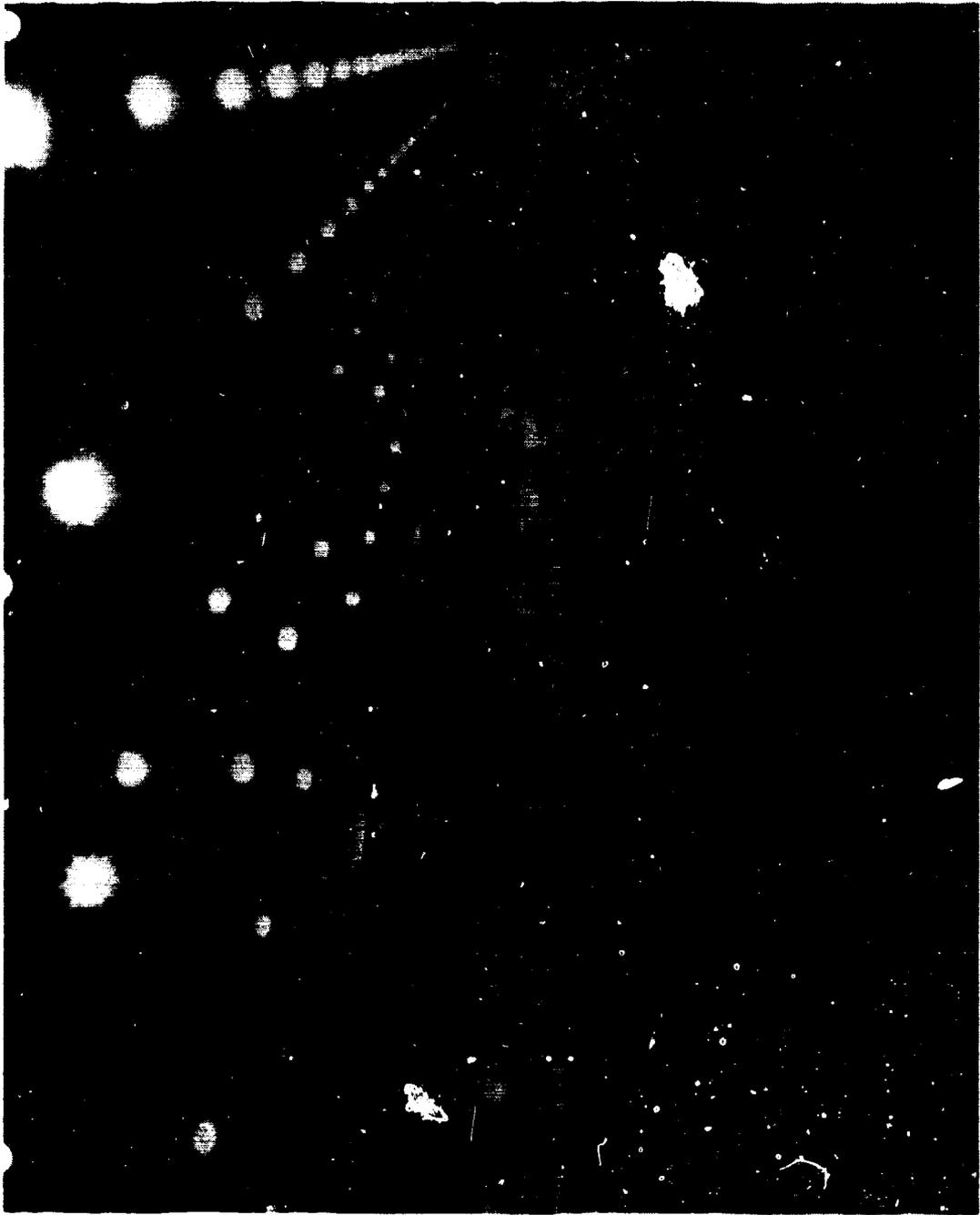


FIGURE 6 LIMA ARMY MODIFICATION CENTER

**U.S. Army's XM-1 Study Group  
Production Site Cost Estimate Summary  
Fiscal Year 1975**

Alternative	XM-1 production at Detroit plant		Combined		XM-1 production at Lima plant	
	Stop M-60	Relocate M-60	production	pro-duction	Unexpanded	foot expansion
	(1)	(2)	(3)	(4)	(5)	(6)

------(millions)-----

**Cost to prepare factory and site:**

Building rehabilitation	\$ 8.4	\$ 8.4	\$ 11.0	\$ 2.9	\$ 2.9	\$ 2.9
Building new	4.7	4.7	7.5	2.0	5.6	11.1
Roads and grounds	.0	.0	.0	.5	.5	.5
Utilities	.0	.0	3.9	2.2	3.2	4.6
Test track	.3	.3	.3	1.0	1.0	1.0
Other (OSHA and EPA)	2.5	2.5	2.5	.0	.0	.0
Production facility equipment and installation	.0	.0	.0	5.8	9.1	14.0
Plant rearrangement	4.0	4.0	4.4	.0	.0	.0
	<u>19.9</u>	<u>19.9</u>	<u>29.6</u>	<u>14.4</u>	<u>22.3</u>	<u>34.1</u>

**Cost for production equipment and set up**

	<u>91.0</u>	<u>91.0</u>	<u>90.3</u>	<u>96.9</u>	<u>99.4</u>	<u>100.9</u>
	<u>110.9</u>	<u>110.9</u>	<u>119.9</u>	<u>111.3</u>	<u>121.7</u>	<u>135.0</u>
XM-1/M-60 program cost variance	<u>63.7</u>	<u>118.2</u>	<u>(a)</u>	<u>19.2</u>	<u>10.8</u>	<u>.0</u>

**Total (alternative costs)**

	<u>\$174.6</u>	<u>\$229.1</u>	<u>\$137.9</u>	<u>\$130.5</u>	<u>\$132.5</u>	<u>\$135.0</u>
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**Estimated monthly tank output capacity:**

XM-1	103	103	80	60	60	103
M-60	0	115	100	150	150	150

a/See pp. 15 to 17 for discussion.

Recognition of the program costs made the first and second alternatives the most costly. These additional costs result from the disruption of ongoing and planned M-60 production. Any disruption in current M-60 production is particularly costly since recent expenditures at the Detroit plant have been made for additional M-60 hull and turret machining lines and other items.

The alternative most preferred by the Army would allow the XM-1 to reach planned production and surge capacity without interference with M-60 production. However, interference between the M-60 and XM-1 programs would be unavoidable if the XM-1 were built at the Detroit plant and were to meet its October 1979 (currently February 1980) initial production date. This slippage was attributable to the Secretary of Defense's program for equipment standardization between the United States and its allies.

Regarding site preference, Chrysler officials told us that they did not prefer one site over another, whereas General Motors officials indicated a preference for the Lima plant. The General Motors officials, however, added that the Detroit plant would be their preferred choice if the facility were used for XM-1 production only.

Officials of both corporations told us that because the major XM-1 components (except the hull and turret) will be supplied by sources other than the prime contractor, uncertainty as to such sources did not affect the Army's site selection decision. They also said that uncertainty as to which prime contractor (General Motors or Chrysler) would be selected probably had no effect on the Army's analyses.

Details on each of the six alternatives are presented in the following sections.

First alternative:  
stop production of M-60

The first alternative allowed for the production of XM-1 tanks exclusively at the Detroit plant while M-60 production would have been terminated. This alternative was the least costly--\$110.9 million--in terms of factory, site, and equipment, yet it still involved \$19.9 million to convert the factory and site for XM-1 use. But, under this alternative, termination costs associated with the cancellation of 302 M-60 tanks on order would be incurred at a \$63.7 million increase in M-60 program costs and a total cost of \$174.6 million.

Under this alternative XM-1 production at the unit cost goal of \$507,790 in fiscal year 1972 dollars could be

achieved, and only a minimum number of production changeovers would be required since some of the equipment utilized for M-60 production is adaptable to XM-1 production. Yet, the immediate termination of M-60 production would result in a M-60 production shortfall of about 4,800 tanks and a 2-year break in all tank production. After production resumed, a maximum of 103 XM-1 tanks could be produced a month at peacetime production rates.

Second alternative:  
relocate M-60

The second alternative provided for the production of the XM-1 tank at the Detroit plant and the relocation of M-60 production to the Lima plant. The same factory, site, and equipment investment as the first alternative--\$110.9 million--would be incurred under this alternative. However, M-60 production at the Detroit plant would have to stop on November 1, 1977, and the preparation of a new site begun for M-60 production. Terminating M-60 production on that date would allow achievement of the XM-1 Program's October 1979 production delivery date (currently February 1980) and thus allow production at the unit cost goal.

This alternative results in two tank facilities but also causes a 7-month break in M-60 tank production with a consequent loss in production of approximately 600 M-60 tanks. After production resumed a maximum of 103 XM-1s and 115 M-60s could be produced a month at peacetime production rates.

The costs of relocating M-60 production fall into three categories: the cost of preparing a new M-60 production site; the cost associated with starting up the new M-60 production line; and the cost of vacating the Detroit plant. These costs were estimated to be \$49.5, \$22.2, and \$46.5 million, respectively. These additional costs bring the total cost of this alternative to \$229.1 million.

Third alternative:  
combined production of XM-1 and M-60

The third alternative allowed for the production of XM-1 and M-60 tanks at the Detroit plant. The Army assumed that the plant layout phases for the XM-1 would be simultaneous with M-60 programmed production and in a manner that would not seriously interfere with the M-60 surge capacity. It is particularly important, in the Army's opinion, for the Detroit plant to remain responsive to any future need to increase M-60 tank production, at least until the XM-1 reaches its peacetime production rate in 1981. However, the combined

production alternative unavoidably affects the XM-1 and M-60 production programs, as discussed below.

The factory and site costs under this alternative amount to \$29.6 million compared to the \$19.9 million for the previous alternatives. The increased costs were a consequence of the additional space, power, and energy conservation requirements needed to sustain two tank programs. All other costs remain essentially unchanged thus making the cost--excluding M-60/XM-1 program cost variances--for this alternative \$119.9 million.

The total cost of this alternative was estimated to be \$137.9 million and was derived after each of four production variations were considered. The XM-1 study group estimated the cost of four variations within the combined production alternative because the XM-1 contractor had not been selected at the time of the study. Details on the four variations follow.

Chrysler as the XM-1 and M-60 contractor;  
M-60 production stopping by 1981

Under this variation the Army believes the XM-1's unit cost goal would not be affected since M-60 production would terminate as the XM-1 program approached its planned production rate of 30 tanks a month. However, there was a cost increase of \$22.2 million associated with the M-60 program since the combined production alternative would result in some interference with M-60 production and require some startup costs after the Detroit plant was rearranged so that M-60s and XM-1s could be produced. Thus, the total cost under this variation was estimated at \$142.1 million.

Chrysler as the XM-1 and M-60 contractor;  
M-60 production continuing until 1989

Under this variation, a Chrysler proposed plan, M-60 production would continue until 1989. Chrysler's proposal of continuing M-60 production through 1989 was not considered a viable variation by the Army because it would not allow production of M-60 tanks in the quantities and time frame desired. The Army's plans call for M-60 production at rates up to 120 a month and the termination of M-60 production by 1981. The total cost of this variation was estimated at only \$62.5 million. Although the factory, site, and equipment cost is \$119.9 million, estimated savings of \$22.5 million in XM-1 program costs and \$34.9 million in M-60 program costs would result primarily from spreading fixed costs of larger production quantities (M-60 and XM-1) over 10 years (until 1989).

General Motors as the XM-1 contractor;  
General Motors taking over M-60 production

Under the third variation, General Motors would have been the XM-1 contractor and taken over M-60 production from Chrysler. Again the factory, site, and equipment cost amounted to \$119.9 million. However, the process of converting M-60 production from Chrysler to General Motors would adversely affect the M-60 program and reduce the cost savings arising from coproduction. The conversion cost was estimated at \$68.5 million for such items as severance pay and vested pension rights. Estimated coproduction efficiency savings amounted to \$4.5 million for the XM-1 program and \$7.8 million for the M-60 program. Also affecting the M-60 program is a cost of \$1.4 million for relocating Chrysler personnel and rearranging the Detroit plant for an XM-1 hull and turret machining line. As a result, the total cost of this variation was an estimated \$177.5 million.

General Motors as the XM-1 contractor;  
Chrysler continuing M-60 production

Under this variation factory, site, and equipment cost was \$113.4 million or \$6.5 million less than under the other three variations. This resulted because less plant rearrangement expense would be incurred since separate contractors would preclude the integration of XM-1 and M-60 production. However, this very same consideration increases the XM-1 program cost by \$6.7 million since fixed costs cannot be spread over a combined XM-1/M-60 production. Furthermore, a \$1.4 million cost is associated with relocating Chrysler personnel and rearranging the Detroit plant for an XM-1 hull and turret machining line. Thus, the XM-1 study group estimated the total cost of this variation at \$121.5 million.

To eliminate any bias as to contractor preference, the XM-1 study group then applied weighting and probability factors against each variation's cost. The sum of the respective totals resulted in a single cost--\$137.9 million--representative of the combined production alternative.

The output estimated under this alternative was 80 XM-1 and 100 M-60 tanks a month. These surge capacities are 53 percent of the desired XM-1 surge and 67 percent of the desired M-60 surge rates attainable under a separate XM-1 and M-60 facility plan (i.e., the Lima alternatives).

Fourth alternative:  
unexpanded Lima plant

The fourth alternative, an unexpanded Lima plant, was the least costly of the Lima alternatives in terms of factory

and site costs. The estimated cost for an unexpanded Lima plant was \$111.3 million or about \$0.4 million more than what would be needed to renovate the Detroit plant for XM-1 production. However, this investment allowed for the utilization of only 580,000 square feet as opposed to the Detroit plant's 1.1 million square feet. As a result more components would be supplied by vendors. This shift in the make/buy plan causes an increase of \$19.2 million in the XM-1 program and makes the total cost of this alternative \$130.5 million. Under this alternative maximum monthly production would be 60 XM-1s and 150 M-60s at peacetime production rates.

#### Fifth alternative: 200,000-square foot expansion at Lima plant

The fifth alternative provided for the expansion of the Lima plant by 200,000 square feet. The cost of factory, site, and equipment was estimated to be \$121.7 million. The investment in factory and site is nearly \$7.3 million less than that required at the Detroit plant under the combined production alternative. The limited expansion results in an increase in the XM-1 program cost of \$10.8 million. The addition of 200,000 square feet allows closer adherence to the baseline make/buy plan and thus a smaller program cost increase. The maximum monthly production remains the same as the previous alternative--60 XM-1s and 150 M-60s at peacetime production rates.

#### Sixth alternative: 500,000-square foot expansion at Lima plant

Under the sixth alternative, the Lima plant would be expanded by 500,000 square feet. The cost of factory and site preparation and equipment was estimated at \$135 million. The increased space and equipment allowed by the additional investment, however, enables the XM-1 to be produced at its unit cost goal. The investment in factory and site costs was \$4.5 million more than that required at the Detroit plant under the combined production alternative but would permit a 40-percent increase in combined XM-1 and M-60 surge capacity--maximum monthly production of 103 XM-1s and 150 M-60s. Of the three Lima alternatives, only the sixth alternative allows production of the XM-1 at its unit cost goal.

#### TANK OUTPUT OF ALTERNATIVES

Maximum tank output under the six alternatives ranged from 103 to 253 tanks a month at peacetime production rates. Tank output received from the cost investment was measured by the capacity of assembling tanks on a 3-shift, 8-hour, 6-day production basis. Output was expressed in tanks a month.

The estimated cost and output of each alternative was as follows:

<u>Alternative</u>	<u>Cost</u>	<u>Maximum monthly tank output</u>			<u>Ratio of output to cost</u>
		<u>XM-1</u>	<u>M-60</u>	<u>Total</u>	
Stop M-60 production	\$174.6	103	0	103	a/0.59
Relocate M-60	229.1	103	115	218	a/ .95
Combined production	137.9	80	100	180	a/1.31
Unexpanded Lima plant	130.5	60	150	210	1.60
At Lima 200,000-square foot expansion	132.5	60	150	210	1.58
At Lima 500,000-square foot expansion	135.0	103	150	253	1.87

a/The cost-to-output ratios involving the Detroit plant differ slightly from the ratios appearing in the XM-1 study group's report because the study group updated the costs. However, the ratios remain in the same proportion relative to each other.

The cost/output ratio table above illustrates several key points:

1. M-60 production reaches the Army's desired maximum surge capacity of 150 only if its production remains uninterrupted at the Detroit plant.
2. The combined production alternative allows a greater surge of M-60 tanks than XM-1 tanks since M-60 hull and turret castings are supplied by vendors whereas the XM-1 will be fabricated within the plant.
3. XM-1 surge capacity at Lima is limited to 60 tanks a month when production area is limited to less than 1.1 million square feet.
4. Under no alternative can XM-1 surge to 150 tanks a month.

Based on the above estimates of cost and output, the XM-1 study group recommended that the Department of the Army select the sixth alternative, expanding the Lima plant by 500,000 square feet.

## PLANS FOR ACHIEVING PRODUCTION OF 60 TANKS A MONTH

Although the contractor site selection studies and the Corps of Engineers' estimates were performed on the basis of a XM-1 production rate of 30 tanks a month, the Army requested the study group to recommend courses of action which would allow a peacetime production rate of 60 XM-1 tanks a month. Furthermore, this production rate would have to be achieved on a 1-shift, 8-hour, 5-day basis; be able to surge to 150 tanks a month; and entail no additional plant construction. The Army's purpose for establishing this requirement was to develop a capacity highly responsive to unforeseen (war loss) or fluctuating (Foreign Military Sales) demands. The need for a second tank production site was not a primary consideration in the site selection process and decision. Rather, a second tank manufacturing facility is a by-product of the decision to initiate XM-1 production at Lima.

The study group considered three possible options: a single plant, a single plant with satellite(s), or two plants. The single plant option would have required the expansion of the Lima plant to 1.7 million square feet at a cost of \$198.8 million. However, the study group believed that the additional \$63.8 million would not be funded in fiscal year 1977 when construction would have to be started. The single plant with satellite(s) option was estimated at \$190.7 million and was disregarded for similar reasons. Furthermore, neither the first nor the second option allowed for competitive production.

Under the third option, a production rate of 60 tanks would be achieved by producing 30 tanks at Lima and 30 at Detroit. The Detroit plant would be converted to XM-1 production after M-60 production terminated. Although the combined cost of this option totaled \$290.8 million, it provided for competitive production and a phased approach since funding could be deferred until after the 1979-1981 time frame. At such a time, the Army could reexamine its future needs and then decide whether the 60 tanks a month requirement was necessary.

## CHAPTER 3

### AD HOC COMMITTEE REPORT

#### ON PRODUCTION SITES

An Army Ad Hoc Tank Production Facility Advisory Committee was established on March 16, 1976, to provide the Assistant Secretary of the Army (Installations & Logistics) with a further analysis and assessment of alternative locations and the associated site preparation costs for production of XM-1 tanks. The Ad Hoc Committee confirmed the XM-1 study group's recommendation that the Lima plant be selected as the initial XM-1 production site. The Committee, however, recommended that the Lima plant be expanded by only about 250,000 square feet. The XM-1 study group had recommended expansion of about 500,000 square feet. The Ad Hoc Committee believed that buildings at Lima not considered by the XM-1 group could be used.

The Committee received briefings from Department of the Army staff concerning the Army Tank Authorized Acquisition Objective, current and projected tank asset posture, and surge and mobilization capacity requirements. In addition, the Army XM-1 study group's report and the summary presentations of General Motors and Chrysler site evaluation studies, including supplementary data, were reviewed, analyzed, and assessed. Finally, plant visits were made by the Committee to the Detroit and Lima plants. Alternative courses of action were then formulated based on these sources of information and evaluated to determine the most favorable approach for achieving the objectives of the study.

The assessment of alternatives was made under the same planning criteria considered by the XM-1 study group (see pp. 2 and 3) except that the Committee also considered XM-1 plans for producing 60 tanks a month with a surge capacity of 150 a month. Because of budgetary constraints, the Committee recommended that the required surge capacity achievement be planned on a phased basis beginning with the establishment of an initial capacity of 30 XM-1 tanks a month with a surge capacity of 75 tanks a month.

#### ASSESSMENT OF ALTERNATIVES

The Committee considered a number of variations to two alternatives: (1) the coproduction of XM-1 and M-60 tanks

at the Detroit plant and (2) the activation of some other facility to supplement the production capacity of the Detroit plant. Realistically, however, only the Lima plant was considered as the "other facility" since both contractors eliminated other potential production sites.

#### Combined M-60/XM-1 production

This alternative called for initiating XM-1 tank production at the Detroit plant. The Committee considered this alternative to be inferior to the Lima alternative since the limited space available would, in its opinion, adversely affect both tank programs. The Committee concluded that the Detroit plant would have to be expanded by about 500,000 square feet in order to sustain XM-1 and M-60 production and surge capabilities at planned levels. Moreover, the Committee believed that the time needed for facility preparation and machine tool installation for XM-1 production would have severely interrupted M-60 production at a time when the Army was in the process of increasing M-60 production from 30 to over 100 tanks a month. In addition, the Committee believed that the ability to surge XM-1 production to 150 tanks a month could not be reached until 1983 under this alternative.

The Committee said the primary advantage of combining XM-1 and M-60 production would be savings in investment dollars. The Committee believed the unit cost of the vehicles would decrease because fixed costs could be spread over both M-60 and XM-1 production quantities. This assumed a single contractor produced both tanks (now a reality with selection of Chrysler for XM-1 production).

#### Initial XM-1 production at Lima with subsequent production at Lima and Detroit

This alternative provided for initiating XM-1 tank production at a rate of 30 a month at the Lima plant and establishing a like capability at the Detroit plant at some future date on a noninterference basis as M-60 production phased down. Having concluded that the Lima plant provided the best initial production site for the XM-1, the Committee then examined various alternatives at Lima to determine which would be the most cost effective. The Committee considered three alternatives: no expansion, limited expansion (about 250,000 square feet), and large expansion (about 800,000 square feet). Expansion limited to about 250,000 square feet was determined to be the most cost-effective alternative since it would allow for a flexible plant layout capable of future expansion at minimum cost

and provide the greatest marginal increase in surge capacity per investment dollar.

The primary advantage gained by initiating XM-1 production at Lima was noninterference with M-60 production and surge capacity. Benefits were also seen to accrue from having two active tank production facilities and skilled work forces.

RECOMMENDED PLAN FOR  
PRODUCTION RATE OF 60 TANKS A MONTH

The Ad Hoc Committee recommended that to achieve an XM-1 surge capacity of 150 tanks a month, the Detroit plant be modified to provide a production rate of 30 tanks a month on a 1-shift, 8-hour, 5-day basis after the XM-1 has reached production maturity and concurrent with the phase down of M-60 production.

The Committee compared cost estimates for modifying two plants versus one. Under the two-plant option, each plant would be capable of producing 30 XM-1 tanks a month with a surge capacity of 75. The one-plant option would be capable of producing 60 tanks a month with a surge capacity of 150. The following table summarizes these estimates with Chrysler as the XM-1 producer:

	<u>Chrysler</u>
	(millions)
Lima	\$163
Detroit	127
Suppliers	<u>133</u>
Two-plant costs	<u>\$423</u>
One-plant costs (if Lima plant used)	a/ <u>\$402</u>
One-plant costs (if Detroit plant used) (note b)	<u>\$360</u>

a/Does not include the cost of closing the Detroit plant, estimated at about \$35 million.

b/M-60 production capacity limited to a maximum of 70 tanks a month; new construction of 160,000 square feet required.

Although the Committee developed cost estimates for using the Detroit plant to produce 60 XM-1 tanks a month, the Committee believed the difficulties inherent in establishing XM-1 and M-60 coproduction in Detroit would not be justified even though capital investment would be lower. The Committee's assessment addressed the question of:

"\* \* \* should the need arise to surge M60 tank production [during the time XM-1 site preparation is in process], to what extent will on-going XM-1 activities impede or even preclude the attainment of this level of production? While not readily quantifiable, experience has demonstrated that interferences, during the construction and reorganization (plant layout) phases, do exist and indeed usually are quite significant."

The Committee concluded that any savings in investment cost would likely be offset in the form of higher recurring costs. Plant layout for coproduction would be constrained because it would be necessary to work around an existing M-60 production operation while preparing for XM-1 production

In January 1977 the Army contracted with the Chrysler Corporation for studies of various alternatives for achieving a production rate of 60 XM-1 tanks a month. The alternatives to be studied utilize only the Lima and Detroit plants as follows:

- Fabrication and assembly of 30 tanks a month at Lima and 30 at Detroit.
- Fabrication of 60 hulls and turrets a month at Lima and final assembly of 60 tanks a month at Detroit.
- Fabrication of 60 hulls and turrets a month at Detroit and final assembly of 60 tanks at Lima.

Chrysler officials said the studies are scheduled for completion in the spring of 1977.

## CHAPTER 4

### OTHER PLANTS CONSIDERED

#### IN SITE SELECTION PROCESS

In chapter 1 we pointed out that the Army requested General Motors and Chrysler to evaluate potential sites other than the Detroit and Lima plants. (See p. 4.) These were:

#### Government owned

- Cleveland Army Tank-Automotive Plant, Cleveland, Ohio.
- North American Plant (Navy), Columbus, Ohio.
- Michigan Army Missiles Plant, Sterling Heights, Michigan.

#### Privately owned

- Chrysler Plant, New Stanton, Pennsylvania.
- Colt International Plant, Dallas, Texas.
- ExCello Corporation Plant, Highland Park, Michigan.
- Phelps-Dodge Brass Plant, South Brunswick, New Jersey.
- U.S. Steel Plant, Elwood City, Pennsylvania.

Both Chrysler and General Motors ruled out all sites except Detroit and Lima as being prohibitive from a technical or cost standpoint.

#### EVALUATION OF THE CLEVELAND TANK PLANT

We were requested to review the suitability of the Cleveland plant for XM-1 tank production and determine if the Army gave appropriate consideration to its use.

Although General Motors and Chrysler did not include the Cleveland plant in their cost studies of potential sites, corporate officials told us that they were familiar with the plant and that it was ruled out based on their knowledge. Chrysler and General Motors had produced vehicles in the Cleveland plant during the 1960s; the heaviest vehicle weighed 25 tons as compared with the XM-1's weight of 58 tons.

Officials of both corporations told us that the major limitations of the Cleveland plant for manufacturing tanks the size of the XM-1 were

--floor weight-bearing capacity and

--crane/structure capacity.

Regarding floor weight-bearing capacity, the main manufacturing building of the Cleveland plant consists of a first floor of 1.3 million square feet, a second floor of 0.4 million square feet, and a basement of 0.6 million square feet. The basement, however, consists of a series of corridors running the entire length and width of the plant. These corridors, which range from 60 to 120 feet in width, weaken the floor weight-bearing capacity of the main floor. The floor weight-bearing capacity of the first and second floors is an estimated 150 to 250 pounds a square foot. According to General Motors officials, production of the XM-1 tank will require a floor weight-bearing capacity of up to 1,800 pounds a square foot. During our inspection of the basement of the Cleveland plant, several deteriorating sections of the main floor were pointed out to us.

The floor weight-bearing capacity of the Cleveland plant was a subject in a prior Army study. In the late 1960s, the Army was trying to develop a new tank (MBT-70), weighing about 50 tons, which would have been manufactured with techniques similar to those to be employed in making the XM-1. As part of that development, the Army studied potential production sites, one of which was the Cleveland plant. The 1969 study reported that:

"The most significant result of the CATAP [Cleveland plant] studies is that any final assembly operation of a vehicle of the weight of the MBT-70 will require construction of a minimum of 287,500 square feet of new plant area with sufficient floor loading capacity \* \* \*"

\* \* \* \* \*

"Due to the floor loading limitation in the main manufacturing building of 150 pounds per square foot over excavated areas and 250 pounds per square foot over unexcavated areas, additional floor space with adequate floor loading capacity is required \* \* \*"

Although the Army did not get cost analyses from General Motors or Chrysler regarding use of the Cleveland plant for producing the XM-1, some tentative cost comparisons can be made between the 1969 MBT-70 study and the 1976 XM-1 study. One plan in the MBT-70 study called for new additions totaling 591,000 square feet. The cost--in 1969 dollars--for plant site work, including additions, was \$40 million. The XM-1 study--in 1975 dollars--proposed that the Lima plant be expanded by 500,000 square feet with plant site costs, including additions, of \$20 million. A Corps of Engineers representative told us that to account for inflation, 1969 costs would have to be increased by 50 to 70 percent.

To obtain a current cost estimate, we requested that the Secretary of Defense provide us an estimate for renovating the Cleveland plant to the extent that would be needed for XM-1 production. In response, the Army provided us estimates of the plant site and facility production equipment costs for the Cleveland plant on the basis of (1) a production rate of 30 tanks a month and (2) 60 tanks a month. Estimates for tooling and effects on program costs were not developed.

The following table compares the estimates for the Cleveland plant with the estimates previously developed by the XM-1 study group for the Detroit and Lima facilities.

<u>Monthly production rate</u>	<u>Estimates of plant site and production equipment costs</u>		
	<u>Detroit</u>	<u>Lima</u>	<u>Cleveland</u>
	------(millions)-----		
30	a/\$26.7	a/\$50.8	\$ 94.6
60		\$77.5	\$117.0

a/These costs were derived from the XM-1 study group report, but it was necessary to realine them for consistency with Cleveland costs. Thus, these numbers will not be found as such in chapter 2.

The above table shows that at a production rate of 30 tanks a month, the estimate for Cleveland exceeds that for Detroit by \$67.9 million and by \$43.8 million for Lima. Furthermore, the table shows that at a production rate of 60 a month, the cost at Cleveland would exceed the combined cost at Detroit and Lima by \$39.5 million.

## CHAPTER 5

### XM-1/M60 PROGRAM ASSUMPTIONS

#### AND OUR CONCLUSIONS

In our opinion the site selection process employed by the Army in coming to the production site decision was both thorough and unbiased. We found that the Army first obtained site studies from the potential producers of the XM-1 tanks, validated the studies, and then reviewed the data with that provided by the Corps of Engineers. The Army's site selection process was in turn evaluated by an outside consultant. Finally, representatives from the private sector provided an analysis and assessment of the alternative sites. Although we did not verify the accuracy of each cost element making up the estimates of the alternatives considered by the XM-1 study group and Ad Hoc Committee, we were satisfied that the cost elements were applied in a manner appropriate to each alternative. Accordingly, we believe the XM-1 study group and Ad Hoc Committee reports reflect the relative values of the alternatives.

Given the planning constraints on M-60/XM-1 production, particularly, the requirements for continued M-60 production and maintenance of an M-60 mobilization base, and the facility requirements needed for XM-1 production, we believe the decision of the Department of the Army in selecting the Lima plant as the initial XM-1 production site was sound.

The factors against using the Detroit plant as the initial XM-1 production site are:

- The need to replenish the U.S. Forces' inventory of M-60 tanks, which was diminished following the 1973 Middle East War, in a short time, i.e., by 1981.
- The need to begin XM-1 production deliveries as soon as practical; i.e., 1980.
- The disruption and interference of both M-60 and XM-1 production that would result if the Army tried to modify the Detroit plant at a time when it is trying to reach a production rate of 120 M-60 tanks a month.

We realize that coproduction of M-60 and XM-1 tanks at the Detroit plant would allow continued use of an existing tank production facility and that capital investment in plant equipment and tooling would be less. We also realize

that recurring costs (the unit cost of M-60 and XM-1 tanks) could be reduced since fixed overhead costs could be spread over two programs and larger quantities. But, to achieve these advantages, the Army would have to accept time and quantity limitations on acquiring M-60 and XM-1 tanks. If the rates of tank production were reduced and production stretched out over a longer time, use of the Detroit plant could be feasible and the most economical way of producing the XM-1 tank.

Because preparation of a production site may take an estimated 2-1/2 years, we believe that delay of the site selection until the Army gets more definite information as to XM-1 characteristics and production specifics is not essential.

The Cleveland plant is suitable for manufacturing but not, in our opinion, for heavy manufacturing like that involved in making tanks the size and weight of the XM-1. Because we concluded that the Detroit and Lima plants are more suited to XM-1 production than the Cleveland plant, we believe the Army did not unfairly eliminate Cleveland from consideration as a possible XM-1 production site.

## CHAPTER 6

### SCOPE OF REVIEW

In assessing the Department of the Army's site selection process and decision, we reviewed the General Motors and Chrysler site selection studies, the site preparation cost analysis of the Lima and Detroit plants prepared by H. K. Ferguson Inc., for the Corps of Engineers, the Illinois Institute of Technology Research Institute study, and the methodology and cost analyses contained in the XM-1 study group and Ad Hoc Committee reports. We also had the Department of Defense provide us with cost analyses for preparing the Cleveland plant to produce XM-1 tanks.

Basically, our review consisted of an evaluation of the Army's methodology in selecting the XM-1 production site. Accordingly, we concentrated our review on facility and not production costs. We did not try to verify the accuracy of all the estimated costs nor did we evaluate or question the Army's determination of its quantity and schedule requirements for XM-1 and M-60 tanks.

We inspected the Detroit plant, Michigan Army Missile Plant, Lima plant, and Cleveland plant. Also, we interviewed Department of Defense, Department of the Army, XM-1 Project Office, Corps of Engineers, H. K. Ferguson Inc., General Motors, and Chrysler officials, and former officials of the Cleveland plant.

Appendixes I through IV are the requests we received from Members of Congress.

LUCIEN N. NEDZI  
14th DISTRICT, MICHIGAN

COMMITTEE ON ARMED  
SERVICES

COMMITTEE ON  
HOUSE ADMINISTRATION

**Congress of the United States**  
**House of Representatives**  
**Washington, D.C. 20515**

November 30, 1976

Mr. John A. Rinko  
Assistant Director  
General Accounting Office  
441 G Street, N.W.  
Attn: PSAD/GP  
Washington, D.C. 20548

Dear Mr. Rinko:

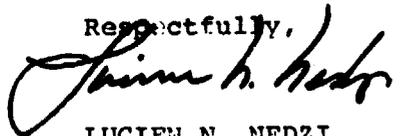
I am writing to you in regard to your ongoing GAO investigation of the Defense Department investigation of the initial XM-1 tank production.

It has come to my attention that Robert J. Horn, Special Assistant to Governor Milliken, wrote to you in October with a list of 28 suggested questions which he hoped that the GAO would include in its inquiry.

I have personally reviewed the suggested questions and have concluded that though the request might have seemed somewhat presumptuous, the questions were nevertheless appropriate and legitimate. Accordingly, this is to formally request that the GAO inquiry include these questions in the course of formulating a comprehensive response.

I look forward to the January 10, 1977 briefing, as agreed.

Respectfully,



LUCIEN N. NEDZI  
Member of Congress

LNN:ejjs

OUR COMMENTS ON  
QUESTIONS RAISED BY THE  
GOVERNOR OF MICHIGAN

1. WHAT WERE THE FACTORS CONSIDERED IN THE SELECTION OF LIMA AS THE PRODUCTION SITE FOR THE XM-1?

The primary factors considered by the Army were:

--Which site allowed continued M-60 production.

--Which site allowed the Army to retain M-60 tank production capacity to meet surge requirements.

--Which site allowed the Army to field XM-1 tanks at the earliest time.

--Which site is most cost effective in meeting overall tank production requirements.

Chapters 2 and 3 discuss in detail the factors considered in the Army's decision.

2. WHAT WEIGHTING WAS GIVEN TO ECONOMICS IN THE EVALUATION OF THE DETROIT ARMY TANK PLANT (DATP) VS. LIMA?

National security, technical feasibility, and economics were factors bearing on the decision. Economics was not the decisive factor. A precise weighting was not assigned and in our opinion, cannot be made because the final decision necessitated judgment.

3. WHAT WAS THE EVALUATION COST FOR FACILITIZING DATP VS. LIMA?

See pages 13, 19, and 23.

4. DID BOTH CHRYSLER AND GENERAL MOTORS STUDY THE FACILITIZING OF DATP AND LIMA UNDER ARMY CONTRACTS?

Yes. The value of those contracts was about \$1 million each. The period of performance was from May to November 1975.

5. WHAT WERE THE GROUND RULES/REQUIREMENTS FOR THESE STUDIES?

See page 4. The contracts contained comprehensive scope of effort statements.

6. WHAT WERE THE RESULTS OF THESE STUDIES? (COMPARATIVE COST, SITE RECOMMENDATION, ETC.)

Because of different manufacturing plans, the contractor cost studies are not directly comparable. Neither contractor made a specific site recommendation. We examined all the contractor study reports during our review. The results are set forth in chapters 2 and 3.

7. IF THE STUDY GROUND RULES DID NOT INCLUDE USE OF THE MICHIGAN ARMY MISSILE PLANT (MAMP) AS A HULL AND TURRET FABRICATION AND COMPONENT MANUFACTURING FACILITY, WHY NOT? DID EITHER CONTRACTOR CONSIDER USING MAMP IN THEIR STUDY?

The contracts with General Motors and Chrysler allowed use of Government-owned facilities but did not specifically require use of MAMP. General Motors did utilize MAMP in its studies.

8. WHAT ARE THE ARMY'S ESTIMATED TOTAL SQUARE FOOT REQUIREMENTS TO PRODUCE 30 XM-1S PER MONTH, 60 PER MONTH AND 150 PER MONTH?

For 30 - 1.1 million square feet on a 1-shift, 8-hour, 5-day basis.

For 60 - 1.7 million square feet if only a single plant used on a 1-shift, 8-hour, 5-day basis.  
2.2 million square feet if two plants used on a 1-shift, 8-hour, 5-day basis.

For 150- Same as for 60 except on the basis of a 3-shift, 8-hour, 5-day week.

9. WHAT IS THE MOBILIZATION PRODUCTION REQUIREMENT AND TOTAL SQUARE FOOT REQUIREMENT?

The mobilization requirement for XM-1 tanks had not been established as of February 15, 1977.

10. WHAT ARE THE SQUARE FOOT REQUIREMENTS TO FABRICATE THE TURRETS AND HULLS AT A RATE OF 30, 60, 150 AND MOBILIZATION REQUIREMENT PER MONTH AS INCLUDED IN THE ABOVE TOTAL FIGURES?

For 30 - 500,000 square feet (1-shift, 8-hours, 5-days).

For 60 - 800,000 square feet (1-shift, 8-hours, 5-days).

For 150 - 800,000 square feet (3-shifts, 8-hours, 5-days).

Mobilization - not established as of February 15, 1977.

11. WHAT IS THE CURRENTLY PLANNED INITIAL PRODUCTION CAPACITY AT LIMA?

Thirty a month on a 1-shift, 8-hour, 5-day basis with a surge capacity of 75.

12. WHAT IS THE CURRENTLY PLANNED PRODUCTION SQUARE FOOTAGE AT LIMA?

1.1 million square feet of which about 250,000 is new construction. About 80,000 of the 1.1 million is for storage and administration.

13. IS THE CLAIMED LACK OF SPACE AT THE DATP FOR CO-PRODUCING THE M-60A1 AND THE XM-1 BASED, IN PART, ON INCLUDING SPACE FOR THE FABRICATION OF THE HULLS AND TURRETS FOR THE XM-1?

Yes, but the primary problem involved in co-production is the extensive XM-1 modification effort which would be required during the period of time when M-60 production is operating at or near maximum rate. Moreover, the objective of an XM-1 surge capacity of 150 tanks a month could not be realistically achieved.

- 13A. IF THIS IS TRUE, WOULD NOT THE USE OF MAMP RELIEVE THIS SITUATION AND ALSO PROVIDE A SURGE CAPABILITY?

If the MAMP structure were adequate to support the heavy weight requirements of XM-1 fabrication and had adequate bay area, both in height and uninterrupted floor space, use of MAMP could help relieve the lack of space at DATP. However, the fact is MAMP does not meet the requirements for XM-1 production since it was designed for light rather than heavy manufacturing.

- 13B. WHAT IS THE SCHEDULE AND PRODUCTION RATE OF THE M-60A1 AND THE XM-1, WHICH IS THE BASIS OF THE CLAIM OF A LACK OF CO-PRODUCTION CAPABILITY?

M-60 production is increasing to a rate of 120 a month for January-July 1978, then phasing down to 80 tanks a month into 1981. The XM-1 production deliveries begin in February 1980 reaching 30 tanks a month in March 1981.

14. IS IT NOT TRUE THAT AS OF MID-AUGUST 1976, FIRM PRODUCTION REQUIREMENTS FOR THE M-60A1 FOR THE U.S. ARMY, USMC, AND FOREIGN MILITARY SALES CARRY THE FISCAL YEAR 1978 PRODUCTION AT 120 PER MONTH ONLY THROUGH JUNE, 1978 AND FROM THAT POINT ON THERE IS OPEN CAPACITY?

Yes. See 13B above.

- 14A. WHY ARE YOU TALKING OF PRODUCING THE M-601A THROUGH 1981?

Because the fiscal year 1979 funding has a delivery period which extends into 1981 because there is an 18 month production leadtime.

15. IS IT NOT TRUE THAT OUR FORMER M-60A1 POTENTIAL CUSTOMERS ARE NOW BECOMING MORE INTERESTED IN THE KM-1, THE LEOPARD 2, THE CHIEFTIAN, AND IN THE LEOPARD 2 AV THAN IN THE M-60A1?

Interest is being shown in those tanks. Iran and the United Kingdom have negotiated a sale of about 1,200 Chieftians. The effect on demand for M-60A1 tanks cannot be projected with precision at this time.

- 15A. WILL NOT THIS GROWING LACK OF INTEREST AFFECT OUR FOREIGN MILITARY SALES OF THE M-60A1 AND CONSEQUENTLY REDUCE THE M-60A1 PRODUCTION REQUIREMENT?

Ultimately, yes. There are, however, firm requirements for M-60 tanks sufficient to require production into 1981.

16. SINCE FOR 2 YEARS XM-1'S ARE TO BE PRODUCED AT A RATE OF ONLY 10 PER MONTH UP TO 30 PER MONTH AT THE SAME TIME THAT THE M-60A1'S ARE PHASING OUT, WHY IS CO-PRODUCTION A PROBLEM?

The problem is that the XM-1 plant modification effort would be at a time of maximum M-60 production. See question 13.

17. IT IS A KNOWN FACT THAT THE PROBLEMS ASSOCIATED WITH THE RECENT PRODUCTION RATE SPEED UP OF THE M-60A1 WERE NOT AT THE DATP PRODUCTION LINE. THE PROBLEMS WERE WITH THE SUBCONTRACTORS. SURGE CAPABILITY DEPENDS MAINLY ON SUPPLIER CAPABILITY. BASED UPON THIS, SHOULD NOT THE MAJOR COMPONENTS BE SECOND SOURCED RATHER THAN THE MAIN PRODUCTION FACILITY?

To meet the XM-1 unit cost goal of \$507,790 in fiscal year 1972 constant dollars, both contractors developed make/buy patterns which bring into the plant a high degree of labor hours thereby minimizing the impact of burden and yielding a unit cost at or below the goal. In addition, XM-1 is of welded construction as opposed to the M-60 cast hull and turret. Thus, one of the major bottlenecks of accelerating is eliminated. The XM-1 production can be accelerated much easier with a welded hull and turret.

17A. WHY DO YOU NEED LIMA WHEN THE DATP AND MAMP CAN HANDLE BOTH THE M-60A1 AND THE XM-1?

This is essentially a statement of what was at issue. Both the XM-1 study group and Ad Hoc Committee concluded that the XM-1 tanks should initially be produced in Lima. The XM-1 program would be initiated during a crucial period--M-60 surging to a programmed production rate of 120 a month. The additional space required for XM-1 production and the attendant construction plus reorganization activities would adversely affect M-60 production. In the event M-60 tank production were surged to 150 a month during the transition period, the XM-1 production schedule would likely slip by a considerable margin. Moreover, the Detroit tank plant is the only active tank production facility in the United States, and any tank needs that may arise between initial production and XM-1 full scale production can only be met with M-60 production. The Army believes that activities associated with plant preparation and bringing XM-1 on stream cannot be allowed to degrade M-60 production capacity. Use of Detroit and MAMP would not only degrade the M-60 surge capacity but also degrade the mobilization capacity should the need arise during the transition from M-60s to XM-1s.

18. WHAT IS THE COST ESTIMATE TO ESTABLISH A SECOND SOURCE AT LIMA AND AT THE DATP?

To achieve a production rate of 60 XM-1 tanks a month, the XM-1 study group estimated the modification cost at about \$290.8 million. (See p. 20.) The Ad Hoc Committee estimated the cost at \$423 million. (See p. 23.) The primary reason for the difference between the XM-1 study group and Ad Hoc Committee estimates was due to the fact the Committee's estimates were based on using the latest (and more expensive) production equipment at the vendor level.

19. IS IT REASONABLE TO LEAVE MICHIGAN'S FULLY DEVELOPED FACILITIES WITH ESTABLISHED ENERGY SOURCES, ARSENAL FACILITIES, TEST TRACK, EXPERIENCED AND AVAILABLE MAN-POWER, AND TO START FROM SCRATCH AT LIMA?

The Detroit facility is not developed, at the present time, in the configuration required for XM-1 production. The fabrication processes involved in XM-1 production are significantly different from those used in the production of M-60 tanks (welding versus castings). Nor does the Detroit plant, at the present time, meet the OSHA and EPA environmental and energy conservation requirements that would have to be met before XM-1 production began. The Army will not be "starting from scratch" at Lima. The Lima facility possesses the essential structural requirements for heavy manufacturing, needing only modernization and expansion to meet the requirements for XM-1 production. All OSHA and EPA and energy conservation requirements will be met during the upgrading of the plant. Modification at Lima will take place without interfering with M-60 production at Detroit. Sufficient manpower possessing the necessary skills will be available in the Lima area for XM-1 production according to Chrysler and General Motors.

20. WHAT IS THE CURRENT ACTIVITY AT LIMA?

In 1959 the Lima plant was placed in an inactive status and since 1961 has served as a storage site for industrial plant equipment. The Center also served as a contingency site for tank production.

- 20A. WHAT ARE YOU DOING WITH THE \$2.1 MILLION IN FISCAL YEAR 1976 FUNDS? (SECRETARY CLEMENTS, DURING HIS TESTIMONY AT THE AUGUST 10, 1976, HASC HEARINGS ON THE XM-1, STATED THAT THIS MONEY IS BEING USED FOR PLANNING ONLY AND THAT THEY ARE NOT GOING TO SPEND A DIME FOR DEVELOPING THE SITE.)

The \$2.1 million of 1976 funds is currently being used to develop the design and modernization requirements for the Lima facility. The initial work that was done prior to site selection was not site sensitive; i.e., electrical, waste, steam requirements determination. This effort was approximately \$400,000. The remainder of the funds is required for site sensitive work and was not started until after the site selection decision was made on August 9, 1976.

- 20B. IS IT TRUE THAT ACTUAL CONSTRUCTION IS UNDER WAY?-  
LAYING UNDERGROUND CABLE AS AN EXAMPLE.

No. Site work is presently scheduled to begin in April 1977.

21. WHAT IS THE URGENCY IN SELECTING THE SITE WHEN THE SELECTION OF THE PRODUCTION CONTRACTOR IS MONTHS AWAY?

Chrysler was selected on November 12, 1976. An estimated 2-1/2 years are required to prepare for and initiate production at the selected production site.

22. WHAT INFLUENCE DID POLITICS AND CONTRACTOR PREFERENCE HAVE ON THE SITE SELECTION DECISION?

Contractor preference did not appear to be a factor. We did not try to determine if politics was involved in the site selection process. This was considered beyond our scope.

23. TO WHAT DEGREE WERE DDR&E, OASD(I&L), AD HOC PANELS AND OTHER GROUPS OUTSIDE OF THE ARMY INVOLVED IN THE SITE SELECTION PROCESS?

See chapter 3 for discussion of the Ad Hoc Committee's involvement. DDR&E was not directly involved because production site selection is under the jurisdiction of OASD(I&L).

- 23A. IS IT TRUE THAT OASD(I&L) WAS BY-PASSED DURING THE FINAL DECISION ACTIVITY?

No.

- 23B. IF NOT PASSED, WHO IN OASD(I&L) WAS DIRECTLY INVOLVED?

The site decision was the responsibility of the Army, but the Deputy Assistant Secretary (MA) was briefed.

- 23C. IF OASD(I&L) WAS NOT INVOLVED, WHY NOT?

See questions 23A and 23B.

24. IS IT REASONABLE TO BELIEVE THAT CONGRESS WOULD APPROVE AN EXPENDITURE FOR A SECOND PRODUCTION FACILITY SHORT OF A WARTIME EMERGENCY?

This question was considered beyond the scope of our assignment.

- 24A. WOULD THE ARMY, IN A TIGHT BUDGET ARENA, EVEN ASK CONGRESS FOR SECOND SOURCE MONEY?

Present Department of Defense plans are to request facility funds for Lima and Detroit.

25. HAS THE QUESTION OF AUTOMATED VS. MANUAL TOOLING BEEN RESOLVED? THE ANSWER TO THIS QUESTION WOULD SURELY HAVE AN EFFECT ON THE PLANNING AND PLANT LAYOUT.

This question was considered in evaluating the various alternatives. It has not been completely resolved at this time.

26. HAS THE ARMY DETERMINED THE EXACT NUMBER OF JOBS INVOLVED IN ASSEMBLY, FABRICATION OF HULLS AND TURRETS, TESTING, ETC.? WHAT ARE THESE FIGURES?

About 1,000 for producing 30 tanks a month.

27. HAS AN ANALYSIS OF JOB TRAINING BEEN MADE IN MOVING FROM THE CENTER OF TANK PRODUCTION FOR THE PAST 35 YEARS?

Both contractors considered this in their studies of alternatives.

28. HAS AN ANALYSIS OF AVAILABLE MANPOWER AT LIMA BEEN MADE? WHAT ARE THE RESULTS?

Analyses were made by the contractors and the Army. The analyses indicate adequate manpower is available in Lima.

29. IS IT NOT TRUE THAT WHEN ALL ECONOMIC FACTORS ARE CONSIDERED, THE FACT IS THAT IT IS MORE ECONOMICAL TO PRODUCE THE XM-1 AT THE DATP THAN AT LIMA?

Yes, when only economic factors are considered. National security factors were deemed to be overriding by the Army.

- 29A. WHY WAS THE DECISION MADE TO GO TO LIMA?

See chapters 2 and 3. In summary, the decision was based on an evaluation of tank production requirements needed for national defense coupled with an evaluation of economic factors.

LUCIEN N. NEDZI  
14th DISTRICT, MICHIGAN

COMMITTEE ON ARMED  
SERVICES

COMMITTEE ON  
HOUSE ADMINISTRATION

**Congress of the United States**  
**House of Representatives**  
**Washington, D.C. 20515**

September 1, 1976

Honorable Elmer B. Staats  
Comptroller General of the United States  
General Accounting Office  
441 G. Street, N.W.  
Washington, D.C. 20548

Dear Mr. Staats:

The Army recently announced that the Lima Army Modification Center at Lima, Ohio, had been selected as the site for initial production of the XM-1 tank. This selection was made despite the fact that the Army finds itself in a period of considerable uncertainty as to which of the three tanks under consideration will win the competition, and even less certainty as to what several major components of the tank will be.

The Army has taken the position that source selection has no bearing on site selection and that cost-effectiveness studies would not be significantly altered regardless of the contractor and components selected. A great deal of stress seems to have been placed on surge capability.

Our belief is that the basic criterion for site selection should be which prospective site offers the most economical means of producing the requested number of tanks. We are concerned that Congress has not been provided adequate data for such a judgment and that, indeed, the Army itself does not have the capacity to make such a judgment at this time. In view of the schedule for the XM-1 production, and particularly in view of the extended delay that will result from the recent, last-minute changes in the source-selection process, it is not clear what purpose is served by the Army designating any site right now.

According to the press release announcing the Lima site selection, there is some reason to speculate that the Army's cost-effectiveness analysis may have been influenced by futuristic plans to facilitate the Detroit Arsenal Tank Plant as a second production site after the termination of the M60 production. Since the Army has never attempted to secure congressional approval for a second-site plan, it would seem premature to give any consideration to such a possibility in the selection of an initial site.

With these introductory remarks, it is requested that GAO examine the XM-1 site-selection process with regard to the following specific points:

(1) Analyze the cost-effectiveness data assembled for each of the alternative sites to determine whether the factors considered and their relative weightings were --and continue to be-- valid and uniformly applied;

(2) Isolate any factors related to source or component selection which would impact on cost effectiveness and determine if they were adequately evaluated during the Army cost-effectiveness analyses;

(3) Determine whether the selection of Lima was influenced by contractor preferences, or whether it would favor either contractor; and

(4) Determine, to the extent possible, the requirement in terms of the national security interest for a second site tank production facility.

We would also ask that GAO comment on the advisability, in view of the considerable changes in the program, of delaying site selection until the Army has more definitive information as to the characteristics and production specifics of the XM-1 tank.

In view of the Army's announced intention to go ahead with facilitization of the Lima site, we would appreciate your prompt attention to this request.

Respectfully,

Walter C. [unclear]

Lucian H. Hedge

[unclear]

[unclear]

[unclear]

[unclear]

Wm Bradford

[unclear]

[unclear]

[unclear]

[unclear]

[unclear]

[unclear]

[unclear]

Al Cederhey

[unclear]

[unclear]

[unclear]

*Phil Russo*  
*Don. [unclear]*  
*Phil Russo*  
*Don. [unclear]*

*Don. [unclear]*  
*Don. [unclear]*

**United States Senate**

September 1, 1976

Respectfully referred to:

The Honorable Elmer B. Staats  
Comptroller General of the United States  
General Accounting Office Building  
441 G Street  
Washington, D. C. 20548

Because of the desire of this office to be responsive to all inquiries and communications, your consideration of the attached is requested. Your findings and views, in duplicate form, along with return of the enclosure, will be appreciated by



.....  
U.S.S.

Form #2

CHARLES A. VANIK  
TWENTY-SECOND DISTRICT, OHIO

2371 TRAYBURN BUILDING  
WASHINGTON, D.C. 20018  
(202) 225-6321

MEMBER:  
COMMITTEE ON WAYS  
AND MEANS  
SUBCOMMITTEES:  
OVERSIGHT, CHAIRMAN  
HEALTH

U.S. COURT HOUSE  
CLEVELAND, OHIO 44114  
(216) 922-4223

SUITE 228  
8031 MAYFIELD ROAD  
LYNDHURST, OHIO 44124  
(216) 922-4223

**Congress of the United States**  
**House of Representatives**

Washington, D.C. 20515

September 9, 1976

The Honorable Elmer Staats  
Comptroller General  
The General Accounting Office  
Washington, D.C.

Dear Mr. Staats:

It has recently come to my attention that the Defense Department plans to build a new \$100 million fabrication plant for its new main battle tank, the XM-1. It is also my understanding that the Army hopes to purchase 3,325 XM-1 tanks. If the tank is chosen for the NATO joint armed forces, tank sales could exceed \$5 billion.

It is my further understanding that an Ad Hoc Tank Production Facility Advisory Committee, comprised of selected representatives from the private sector, provided an independent analysis pertaining to the selection of a production site. The Army subsequently selected the Lima Army Modification Center in Lima, Ohio and the United States Army Tank Plant in Warren, Michigan as production sites. It was decided that initial XM-1 production will take place at the Lima facility. The plan is then to establish a plant in Warren, Michigan as a second XM-1 production facility in the early 1980's.

The Army contends that the Brookpark Tank Plant was not selected as the production site since it does not lend itself to the manufacturing processes needed in the production of the new XM-1 tank.

I find it incredible to believe that the Brookpark, Ohio Tank Plant could not be adapted to fulfill the mission of XM-1 tank production. It was specifically constructed and designed as one of the best tank production facilities in the world.

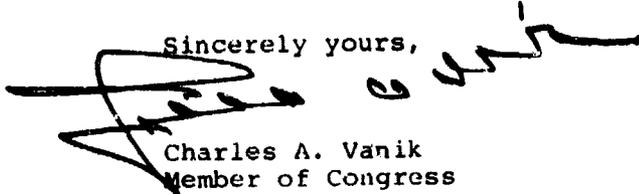
The Honorable Elmer Staats  
September 9, 1976

The suitability of this facility for tank production has not been changed. It has an excellent record for efficient productivity and it can be modified as readily as the Lima facility. The Cleveland area offers skilled labor, management personnel, sufficient power, availability of raw materials, as well as land, air and water transportation.

Will your office kindly review the decision and procedure on site determination. If the Brookpark Tank Plant is suitable for XM-1 production, the decision to build new plants elsewhere could constitute a \$230 million mistake, resulting from the cost of building a new facility for \$100 million and the failure to use an existing facility with a value estimated at \$130 million.

It is my hope that your office can immediately determine the specific reasons why the Brookpark, Ohio site was overlooked.

Sincerely yours,

A handwritten signature in black ink, appearing to read "Charles A. Vanik", is written over the typed name and title.

Charles A. Vanik  
Member of Congress

CAV:det

LIST OF REPORTS PREPARED BY  
CONGRESSIONAL ORGANIZATIONS ON  
XM-1 MAIN BATTLE TANK

eral Accounting Office Report on Critical Considerations  
the Acquisition of New Main Battle Tank (PSAD-76-113A,  
uly 22, 1976). This report discusses the XM-1's develop-  
ent to date and raises questions about issues that we felt  
ere critical to the final acquisition decision.

gressional Research Service, Library of Congress, Issue  
rief on the XM-1 Main Battle Tank Program (1B75052,  
ecember 6, 1976). This report discusses the need, cost,  
ulnerability, and possible alternatives to the XM-1 main  
attle tank.

gressional Budget Office Issue Paper on Planning U.S.  
eneral Purpose Forces: Army Procurement Issues (December  
976.) This report includes a discussion on the options  
pen to the Congress with regard to the XM-1 main battle  
ank.



DEPARTMENT OF THE ARMY  
OFFICE OF THE ASSISTANT SECRETARY  
WASHINGTON, D.C. 20310

30 MAR 1977

Mr. R. W. Gutman  
Procurement and Systems Acquisition Division  
United States General Accounting Office  
Washington, D.C. 20548

Dear Mr. Gutman:

This is in reply to your letter to the Secretary of Defense regarding the GAO draft report dated March 16, 1977, entitled, "Selecting the Production Site for the Army's New Main Battle Tank", OSD Case #4577, (GAO code 950364).

We acknowledge receipt of the draft report and concur with your findings and opinion. The XM1 production site decision was a key factor in the Army's overall tank production base planning effort. Of critical concern was the maintenance of a production base sufficient to meet the Army's projected tank requirements during the transition from production of M60 series tanks to XM1s. Therefore, this action was assigned a high priority and was subjected to a very thorough and judicious evaluation.

The opportunity to review the draft report is appreciated.

*Arthur Jacobs*  
Major General, USA  
Deputy for  
Material Acquisition



PRINCIPAL OFFICIALS RESPONSIBLE FOR  
ACTIVITIES DISCUSSED IN THIS REPORT

	<u>Tenure of office</u>	
	<u>From</u>	<u>To</u>
<b>SECRETARY OF DEFENSE:</b>		
Dr. Harold Brown	Feb. 1977	Present
Donald H. Rumsfeld	Nov. 1975	Jan. 1977
James R. Schlesinger	July 1973	Nov. 1975
<b>ASSISTANT SECRETARY OF DEFENSE (INSTALLATIONS &amp; LOGISTICS):</b>		
Dale R. Babione (acting)	Jan. 1977	Present
Frank A. Schrontz	Feb. 1976	Jan. 1977
John J. Bennett (acting)	Mar. 1975	Feb. 1976
<b>SECRETARY OF THE ARMY:</b>		
Clifford L. Alexander, Jr.	Feb. 1977	Present
Martin R. Hoffmann	Aug. 1975	Jan. 1977
Howard H. Callaway	July 1973	Aug. 1975
<b>ASSISTANT SECRETARY OF THE ARMY (INSTALLATIONS &amp; LOGISTICS):</b>		
Edwin Greiner (acting)	Jan. 1977	Present
Harold L. Brownman	Oct. 1974	Dec. 1976
Edwin Greiner (acting)	Aug. 1974	Sept. 1974