The group proposes that a specific agency be assigned responsibility for developing systematic procedures for accomplishing proper trade-offs among time, cost, and effectiveness.

5.7 LEAD TIME CONTROL

Both the Army Scientific Advisory Panel in 1958, and the MRRC in 1961, recommended organizational changes to reduce lead time. Some of these changes did, in fact, take place.

We submit that it is not sufficient to change an organization in anticipation of improving one of its performance characteristics unless that characteristic is established as a control parameter. There must be subsequent management action to control the organizational performance to the desired performance objective.

We feel that the specification by the MRRC of a four-year, Leadtime Goal and the publication of AR 11-25 were insufficient measures in that the means of controlling the development process to achieve a four-year lead time was not specified. We consider the subsequent erosion of the Lead-Time Goal to be an indication of how goals which are not control parameters can be displaced. However desirable the organizational changes recommended by the MRRC may have been, there was no provision for a mechanism by which further changes and adaptions might be accomplished if the specified goal was not achieved.

We therefore propose the following process. As we have noted elsewhere we are convinced of the Army's capability to perform a self-analysis of the development problems which it encounters, both with regard to lead time specifically, and with regard to the development process as a whole.

We propose that at the completion of each major phase in development, i.e.,

Type Classification Conditional Standard A

Type Classification Standard A

First Issue to Troops

and in particular, when the project cognizance passes to DCSLOG that a critical evaluation be prepared and signed jointly by the project manager and the DASSO, providing - in equivalent detail to the excellent case studies on which this Group was briefed - an assessment of the causes of schedule slippage.

We propose that once each year, these accumulated reports be reviewed at the Chief of Staff level with the object of modifying the management system to achieve the consistent realization of lead time goals.

Since ACSFOR is charged with "revising and improving the management model to reflect experience with the management system," ACSFOR would appear to be an appropriate agency for preparing conclusions and recommendations, and staffing the approvals.

We believe that this annual review, with provision for immediate implementation of recommendations, would have a higher likelihood of producing system adaptation to Lead Time Goals than periodic investigation by ad hoc committees.

SECTION 6

CASE STUDIES

6.1 GENERAL

The Group received an excellent series of briefings on the developmental history of Army materiel programs ranging from helicopters to combat boots. These briefings developed for us, in detail, the causes of lead-time slippage and the circumstances under which programs moved rapidly. We were shown PERT diagrams and schedules for many programs, and lists were provided of events which had caused schedule and cost to change.

As a result of these briefings and studies, we are convinced that the Army is entirely capable of performing a self-analysis of the causes of long lead time, project by project.

In addition, we were made aware of, and reviewed carefully, the Case Studies performed by the MRRC in 1961.

6.2 MRRC FINDINGS

The MRRC report brought out, on the basis of analysis of 23 Army materiel programs, the many causes of undesirable extensions of lead time, and the conditions favoring short lead time. The report included for comparison, development procedures of other government and industry practices in the U.S. It includes a comparison of U.S. and estimated Soviet lead time.

The reported causes of delay run the gamut of poor management, lack of coordination, numerous analyses and reviews required, decision and procedural delays, failure to determine technical feasibility, and the consequent lack of understanding of the technical problems involved, inadequate and unduly severe requirements, upgrading of requirements, insufficient appraisal of user conditions, delays in contracting, inadequate and intermittent funding, and so on.

While there have been subsequent improvements in many respects, many causes still prevail in varying degrees, as determined from the Case Studies presented to the present Group. Army reorganizations, such as the establishment of CDC and AMC, and the use of project managers in AMC can have, and have had, desirable effects.

6.3 OBSERVATIONS OF PRESENT GROUP

Listed below, and based on the briefings given us, are some of the characteristics of successful programs, accomplished in acceptable lead time, and characteristics of programs which required extended development time and in some cases were unsuccessful.

(a) Characteristics of successful programs:

High level interest and attention.

Delegation of full authority to project manager and exercise of that authority.

Close liaison with user.

Sound initial concept.

Same project manager in test phase as in development.

Continuity of project manager in product area.

Limited coordination required across commands within Army.

Competent in-house supporting technical group.

(b) Causes of extended lead time:

Delay in DA decision to initiate.

Engineering development initiated prior to QMR.

Failure to recognize technical problems.

Recognized risk areas not backed up by parallel development.

Lack of adequate concept formulation.

Change of requirements during development.

Transfer of project management responsibility between development and production.

Inter-service coordination.

Administrative lead time.

Poor contractor performance by a contractor having a prior record of poor performance.

Mid-course upgrading of "quick-fix" solutions to meet world-wide requirements.

Directed geographical move of contract performance.

Delay in delivery of components.

Delay in initiating training aids program.

Transition from engineering development to production.

Difficulty in obtaining multiple bids on total package procurement.

Delay in correcting deficiencies noted in testing.

The programs which have had reasonable lead times are characterized in general by top priority within the Army and higher authorities, proper identification of the desired design and its feasibility, a consequent understanding of the technical problems, selection of components and performance not too far beyond the state of the art, some requirement flexibility for tradeoffs, a high degree of concurrency in development and preparation for production (for which a single contractor for development and first production is almost essential), willing and eager cooperation, responsible and competent management which could be given authority, and adequate funding. (Illustrations: Jupiter, Pershing, M48 Tank.)

These general comments may be further qualified by reference to specific product types:

(a) Helicopters

Significant delay has been incurred in concept approval by DA. Once approved, lead-time performance on helicopter development has been generally acceptable. We are inclined to feel that at least a part of this success is attributable to the aggressiveness and competitive strength of the aircraft industry, as well as to the straightforward nature of the military characteristics. The increased complexity of avionics, as in the case of the Cheyenne, may create future problems.

(b) Ground Vehicles

Ground vehicles are a mixed bag. We note the rapid response anticipated on the unconventional (M561) truck, which was developed by an aerospace contractor, but view this in the context of the extensive development program carried out prior to Army funding by the contractor. The non-responsiveness to change by the Army's customary contractors in the automotive industry is evidenced by the inability of the Army to obtain more than one bid on a total package procurement basis for the conventional XM 705 truck. In the testing section of this report, we comment on the apparent retarded state of the art in vehicle test programs, equipment, and procedures. We were not encouraged by the leisurely development schedule proposed for the MICV, especially since much of the extension was attributed to "administrative lead time." Vehicle development appears to be deficient in the ability to do cost-effectiveness evaluations to assess the value of possible component improvements. At the same time, the relatively low funding for exploratory and advanced development as compared to the extremely large expenditures for acquisition and operation is not likely to generate a wide range of options for substantial performance gains. As long as state of the art is not advancing rapidly in this area, extended developmental lead time is not likely to extort a high price in comparative operational capability. Our concern is that it may be an indicator that the limited R&D resources which the Army can apply to vehicles are not being used efficiently.

(c) Missiles

Some first generation missiles for which there was a critical need have gone through development well (Pershing, Nike Ajax and Hercules, and Hawk). Improved Hawk and SAM-D have been impeded by periodic fluctuations in the requirement to engage tactical ballistic missiles. Chaparral was delayed by a major change in requirement from a quick-fix system for Vietnam to a world-wide requirement. It is more difficult to understand the long lead time associated with Redeye,the failure to provide early back up for recognized risk areas, and the delay in developing an operational concept. In the case of Lance, the preliminary development of the simplified guidance system was apparently not associated with an appreciation of the technical problems which this imposed on the propulsion system. It is difficult to generalize with regard to the wide variation in success among missile programs. We note, however, that the programs cited as outstanding examples of rapid development (Redstone, Jupiter) and those experiencing substantial delays and tachnical problems (Redeye, TOW, Lance) tend to be separated by the transfer of a major portion of the Army's in-house technical strength in missilry to NASA, and may be a reflection of the problems in re-organizing and replacing the lost capabilities,

The value of a strong in-house capability which can be used in direct support of development is indicated by the fact that short development time has often been associated with urgent programs to which the Army could apply a competent in-house technical team, as in the case of the 2.75 inch fuze. Natick programs appear to have gone well; in the case of clothing the amount of interface with other Army development agencies is minimal. The SATCOM Terminal went well and required little intra-Army coordination. The latter fact facilitated simplified management procedures.

Programs which required close cooperation by different and widely separated Army development agencies, in addition to the contractor (vehicle, weapon, electronics, warhead), have encountered delays caused by component phasing (Sheridan, Lance, Shillelagh).

With an RDT&E budget half that of the Air Force, the Army has twice as many RDT&E installations (61 compared with 27), and more than twice as many professional military and civilian personnel engaged in RDT&E (17,564 compared with 7,653). The reasons for so wide a difference are historical, and the proportionately greater in-house capability of the Army is not necessarily either bad or good. There is, however, a strong inference that the coordination problems of an Army project manager requiring support in a number of disciplines and commodity areas may be substantially greater than those of his opposite number in the Air Force or the Navy (which occupies a median position in the above numbers).

6.4 SUMMARY

The following problem areas identified by the MRRC remain current:

Requirements: Requirements continue to be late in formulation, subject to major change during programs, incompletely defined in advance, and once established may be difficult to relax to balance availability date, cost, and operational performance.

Administrative Lead Time: Still introduces significant program delays.

Inter-service Coordination: A major problem.

Intra-Army Coordination: A major problem.

Transition from Development to Production: Unless planned carefully in advance, invariably introduces major delays.

Funding was less frequently mentioned as a problem area than indicated by the MRRC but is still cited as a cause of delay on some programs. The Project Manager system is growing in effectiveness, although handicapped by the difficulty of working across Commands.

Progressive consolidation of the Army's RDT&E installations by collocation seems a highly desirable long term objective, but we recognize the political problems. Further fragmentation should by all means be avoided.

APPENDIX A

MEMBERSHIP OF THE AD HOC GROUP ON DEVELOPMENTAL LEAD TIME

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MEMBERSHIP OF THE AD HOC GROUP ON DEVELOPMENTAL LEAD TIME

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APPENDIX B

LIST OF BRIEFINGS TO THE AD HOC GROUP ON DEVELOPMENTAL LEAD TIME

APPENDIX B

LIST OF BRIEFINGS TO THE AD HOC GROUP

ON

DEVELOPMENTAL LEAD TIME

Subject	Date	Briefer
U. S. Army Combat Developments Organization and Procedures	29 Jan 68	LTC James W. Ryan Mr. D. C. Hardison USACDC
U. S. Army Materiel Command Organization and Procedures	29 Jan 68	
Management/Control of Materiel Development		Mr. Robert Alexander Mr. Richard White USAMC
Leadtime Discussions		
2.75" Fuse Development		Dr. M. Apstein Harry Diamond Lab.
Surface to Air Missile SAM-D		Mr. C. Cockrell Project Manager's Office
Cheyenne		Mr. J. Stolarick Project Manager's Office
Exploratory Development Planning		Mr. L. Roepcke USAMC
Army System for Development and Production of Materiel	30 Jan 68	COL J. A. Stuart OCRD
Army Materiel Life Cycle Management Model	30 Jan 68	COL W. C. Lowry OACSFOR
MRRC Lead Time Study	14 Mar 68	COL G. E. Sayre DIA

APPENDIX B

Subject	Date	Briefer
EDEYE in Comparison with HAPARRAL	14 Mar 68	COL J. R. Covert COL R. C. Daley Project Managers
ERSHING	14 Mar 68	Mr. C. A. Tidwell Project Manager's Office
AMMA GOAT and Truck XM705	14 Mar 68	LTC J. A. Check Project Manager
OW	14 Mar 68	Mr. R. Q. Taylor Project Manager's Office
HEYENNE (AAFSS)	14 Mar 68	Mr. J. Stolarick Project Manager's Office
A Board of Inquiry on the rmy Logistics System Brown Board)	8 Apr 68	LTC R. B. Testerman ODCSLOG
evelopment Project on 2.75" roximity Fuze	8 Apr 68	Dr. M. Apstein HDL
ropical Combat Boot	8 Apr 68	Mr. T. L. Bailey NATICK Lab
round Smoke Signals M 166 thru 169	8 Apr 68	Mr. R. G. Thresher USALWL Mr. G. H. Cowan USAMUCOM
rojectiles XM 629 and M 631	8 Apr 68	Mr. P. Monteleone USAMUCOM
07mm Mortar XM 95	8 Apr 68	Mr. E. G. Frezon Watervleit Arsenal
NSURE	8 Apr 68	LTC Jon J. Sugrue USAMC

APPENDIX B

Subject	Date	Briefer
CDOG, QMR and QMDO	6 May 68	COL (Ret) C. B. Mitchell OACSFOR
Army Force Development Plan	6 May 68	LTC A. M. Karns OACSFOR
Total Feasibility Studies	6 May 68	MAJ J. W. Hudachek OACSFOR
Tactical Automatic Switching	7 May 68	COL Bryan Cowan Project Manager
Air Transportable Lightweight Satellite Communication Terminal AN/TSC-54	7 May 68	Mr. R. deSante USASATCOM Agency
The Army's System of Project Management	29 July 68	Mrs. S. Clements USAMC
The Army Research Program	29 July 68	BG C.D.Y. Ostrom OCRD
Correlation of R&D Projects and Tasks with Requirements and Objectives	29 July 68	Mrs. H. Bass LTC C. F. Lemr OCRD
Army Management Information Systems	29 July 68	COL H. C. Schrader LTC W. J. Hilsman OAVCofSA
Army Materiel Test and Evaluation	29 July 68	MAJ J. E. King OCRD
Air Force 375-Series Manuals and Management System	30 July 68	LTC J. C. Shively HQUSAF DCS S&L
Air Force Project Review System	30 July 68	COL W. R. Becker HQUSAF DCS R&D

APPENDIX B

R&D and Lead Time Intelligence Estimate	30 July 68	Mr. David Latt Foreign Science and Technology Center
OSD Project 80 (Army) Hoelscher Report)	30 July 68	BG E. A. Bailey Dr. John Ord USAMC
Development of Materiel Objectives and Requirements; Transition from QMDO to QMR	28 Aug 68	Mr. J. E. Harris USACDC Mr. C. L. Thulin USAMC
Discussion on Joint CDC/AMC Briefing	28 Aug 68	Mr. D. C. Hardison Mr. J. E. Harris USACDC Mr. L. A. Roepcke Mr. C. L. Thulin USAMC

APPENDIX C

LEAD-TIME GOALS

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LEAD TIME GOALS

AR 11-25 Army Programs, Reduction of Lead Time, 27 September 1961

This regulation sets "forth responsibilities, objectives and specific actions required by the Department of the Army which will contribute to a reduction of lead time from inception of an idea for materiel to equipment in the hands of U. S. Army troops." In particular it states "The lead time objective of the Army is four years or less from project initiation to first production rolloff of materiel, followed by expeditious procurement in adequate quantities of selected items that make the greatest contribution to improvements in Army combat effectiveness."

AR 70-10 - Army Materiel Testing, 18 December 1962

This regulation stated, "A test leadtime goal of one year or less, within the overall Army leadtime goal of four years from project initiation to first production rolloff (AR 11-25) is established."

AR 705-5 - Research and Development of Materiel, 15 October 1964

This regulation states that "both speed of execution and quality are essential characteristics of Army research and development. Any authorized action should be taken to reduce the time required to satisfy a qualitative materiel requirement. The development leadtime goal is four years or less from initiation of development effort in the engineering development/operational system development category to type classification of the item or system as standard. In addition, production engineering and necessary programming, procurement planning, and administrative actions should be initiated as early as practicable during the development cycle in order to minimize the time required from type classification to first production rolloff."

AR 705-5 - Research and Development of Materiel, April 1968

This regulation states, "Both speed of execution and quality are essential characteristics of Army research and development. Any authorized action should be taken to reduce the time required to satisfy a qualitative materiel requirement. The development leadtime goal is four years or less from initiation of development in the engineering development/operational systems development category to type classification of the item or system as Conditional Standard A. In addition, production engineering and necessary programming, procurement, maintenance and logistical support planning and administrative actions should be initiated as early as practicable during the development cycle." This regulation also gives as an objective of advanced engineering and operational system development, to "Maintain a reasonable balance between reduction of lead time and achievment of utility."

AR 11-25 - Army Programs, The Management Process for the Development of Army Systems, 10 April 1968, supersedes AR 11-25 of 1961 on Lead Time.

This regulation differs completely from the regulation it supersedes and now has nothing to say about lead time.

APPENDIX D

SUGGESTED EMPHASIS ON TIME-IN-BLOCK ACTIONS OF MANAGEMENT MODELS

Suggested Emphasis on Time-in-Block Actions of Management Model

Block	Title	Comments
7	Advanced Materiel Concept	Times at which specified, improved capabilities are considered feasible should be estimated
8	Land Combat Systems Study	Add to Paragraph 8a, "and the expected time of availability"
10	Operational Capability Objective	The OCOs should describe the capability improvements desired at various future time goals
14	Objectives for Technology	The goals will vary in level with time and should be so specified
15	Proposed QMDO	The need should be expressed in terms of performance increment and date required May be a set of increments versus time
16,17	QMDO	Same as Block 15
22	Parametric Design Studies (QMA)	The Studies must explicitly consider time of availability as a parameter in addition to cost and performance
23	Mission and Performance Envelopes	Add time to yield mission/performance/time envelopes
24	Technical Approach Identified	Compare expected performance and availability date with OCO goals (Block 10)
28→31	Advanced Development Plan	Determine consistency between program duration and expected payoff at operational date
32	Trade-Offs Determined	Include operational date as a parameter and determine trade-offs among performance, resource costs, and <u>time</u>
33	Analysis of Trade-Offs	Compare different schedules with regard to performance, operational date, cost, etc. Indicate trade-off of performance versus time versus cost if program slips
38	Best Technical Approach Identified	Maximum acceptable developmental lead time stated here and feasibility of attaining it determined
41-42	Approval of QMR	Developmental lead time must be specified with a plan to achieve it. A maximum of four years from QMR approval to type classification must be specified

Suggested Emphasis on Time-in-Block Actions of Management Model

Block	Title	Comments
47-48	Develop Proposed System Development Plan	This plan must specify developmental lead time with plan to achieve it, and also latest operational date at which expected performance gain will be adequate
49	Command Position	Revalidate expected capability gain versus expected operational date. Should operational date be expedited?
51-52	Information Exchange	Explicitly consider appropriateness of expected operational date
53-56	Contract Definition	Explicitly specify developmental lead time and present plan to achieve it
70-71	Operations Analysis of Trade-Offs	Ensure that capability expressed in OCO and QMR can be attained within performance envelopes at time required
77-78	Command Position for SSE on CD	Same as Block 49
80-81	Information Exchange	Same as Block 51-52
82	DA Evaluation of Program Status	Explicitly consider slippage, if any, of expected operational date and possible need to expedite
110	Master Plans and Schedules for Development	Explicitly show that developmental lead-time objectives and operational date objective are met
114	Doctrine, Materiel, Organization	Specifically consider expected operational date
141-142	Command Position	Same as Block 49
144	Information Exchange	Same as Block 51-52
151	Evaluate Results of DAT	Confirm that desired operational capability will be achieved at sufficiently early date

APPENDIX E

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