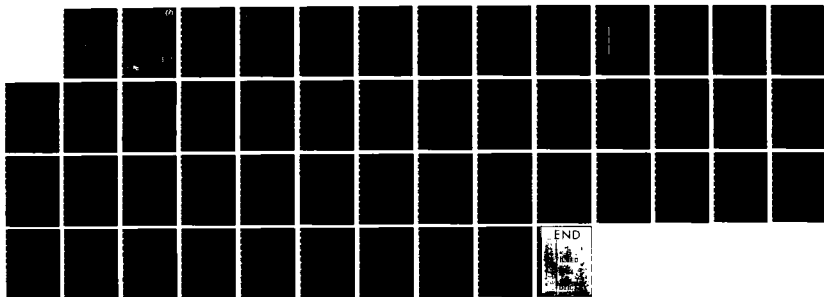REQUIREMENTS ANALYSIS FOR FORWARD FUNDING TRACKING
SYSTEM VOLUME 1(U) MERIDIAN CORP FALLS CHURCH VA
01 DEC 83 MDA903-83-C-0342

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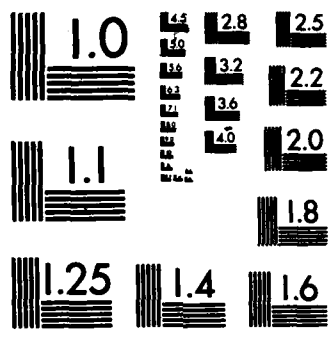
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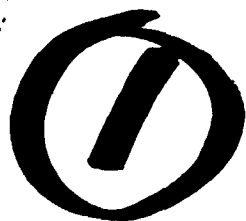NL

END

MICROCOPY RESOLUTION TEST CHART

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REQUIREMENTS ANALYSIS
FOR
FOWARD FUNDING TRACKING SYSTEM

FINAL REPORT – VOLUME I

DECEMBER 1, 1983

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Meridian Corporation

D I S C L A I M E R

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REQUIREMENTS ANALYSIS

FOR

FORWARD FUNDING TRACKING SYSTEM

FINAL REPORT - VOLUME I

December 1, 1983

Sponsored by

Defense Advanced Research Projects Agency

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Defense Supply Service - Washington,
Washington, DC 20310

Prepared by

Meridian Corporation
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Falls Church, Virginia 22041

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EXECUTIVE SUMMARY

This report documents work performed by Meridian Corporation,under Contract
No. MDA903-83-C-0342. The purpose of this effort was to analyze the feasibility
and cost effectiveness of developing a forward funding tracking system which was
capable of utilizing existing DARPA data bases (Vol. I) and a milestone tracking
system for internal use by DARPA management (Vol. II).

These requirements analyses were accomplished through interviews with DARPA
personnel in the Program Management Office, Technical Offices, Financial Manage-
ment Division, and Management Information Systems Division. User requirements
were identified, and potential solutions were promulgated. After review with the
affected personnel, the list of potential feasible solutions was reduced and is
contained in this report.

The major findings indicate that a forward funding tracking system is warranted
and a fairly uncomplicated, inexpensive means of identifying potential occurrences
of forward funding can be implemented by generating reports using existing Fiscal
Data Base information. However, more involved measures are necessary to analyze
other aspects of forward funding and should be assessed and if possible quantified
in terms of costs versus benefits. Moreover, simple methods and procedures by
which PMOs and Technical Office program/project managers would be able to analyze
reports and customize additional report and data base queries are warranted and
should be explored.

With respect to milestone tracking, it was found that no mainframe computer
application was feasible. Rather, due to the narrow range of interest expressed
in the automated milestone tracking system, a single-user, microcomputer-based
system is the optimal alternative. The study recommends the development of design
specifications for a microcomputer-based system, with particular emphasis on
determining the degrees of user-friendliness and flexibility required.

1.0 INTRODUCTION

This report documents work performed by Meridian Corporation under Contract No. MDA903-83-C-0342. Volume I of this report focuses on the efforts undertaken with respect to the requirements for a Forward Funding Tracking System. The purpose of this effort was to analyze the feasibility and cost effectiveness of developing a forward funding tracking system which was capable of utilizing existing DARPA data bases. Used in this context, forward funding tracking refers to the process by which DARPA commits, obligates, and ultimately manages its fiscal resources.

The motivation behind this analysis was the need to provide the DARPA Program Management Office (PMO) with sufficient information to enable an informed decision regarding the effectiveness of potential approaches to financial management. This need is a principal concern to the PMO, since it is the responsibility of this office to plan, manage, and control, at the aggregate level, DARPA program funds and project scheduling. In addition, within the context of the overall DARPA mission to pursue high-risk, high-payoff R&D, it is incumbent upon the technical program offices to manage individual projects from a technical, cost, and schedule point of view. Consequently, the coordination of the resource requirements for management of these individual projects is also a primary concern to the PMO.

Unfortunately, the size and complexity of DARPA programs may in the foreseeable future tax the capacity of manual project management procedures to plan funding requirements and control contract performance. Moreover, the increasing number of DARPA programs and their interrelationships demand that an integrated approach be adopted for the management and control of DARPA resources. Unless such an approach can be developed expeditiously, it is anticipated that reporting and control difficulties will compound and hence may ultimately adversely impact the PMO's ability to fulfill its management responsibilities.

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These management responsibilities dictate the nature of the support which an automated data base must provide. Management support requirements vary dependent on the purview of the managers involved, and consequently it is not surprising that differing levels of DARPA management have differing requirements for project status information. This concept is illustrated in Figure 1-1.

As shown in this figure, managers of individual projects need timely information to monitor the status of their projects, to evaluate contingency plans, and to analyze cost, schedule, and technical status projections. Managers at the office level (e.g., Directed Energy Office) need to be concerned with similar issues, but at a higher level of aggregation. In addition, such managers have responsibility for assuring the successful integration of complementary projects, and consequently need information pertaining to interproject dependencies and cost, schedule, and technical performance trends. Finally, managers at the agency level require cost, schedule, and technical information at a still higher level of aggregation, and need special analytical tools to track agency-wide funding requirements, to assess appropriate levels of management reserves, and potentially to support Source Evaluation Board selection processes.

The management support tools necessary to sustain these functions are currently at different stages of development. For example, the data bases and analysis procedures to support the budget formulation process in the Technical Offices are well defined and operational. Other functions, such as the evaluation of alternative management contingency plans, are not adequately supported by the data bases and analytical tools maintained by the PMO. The analysis presented in this document is oriented toward the design of additional analytical capabilities to be incorporated into DARPA's existing management information system, which will provide the PMO with automated techniques to 1) anticipate program requirements, and 2) evaluate the implications of past performance of specific DARPA programs on the overall DARPA mission.

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FIGURE 1-1
MANAGEMENT SUPPORT REQUIREMENTS

INDIVIDUAL PROJECT MANAGEMENT
- Assess baseline feasibility
- Monitor project status
- Evaluate management and technical contingency plans
- Develop risk budgets based on project specific data

PROGRAM OFFICE MANAGEMENT
- Interactive budget formulation using up-to-date reports of project status
- Evaluate the effects of interproject dependencies
- Scope magnitude of office wide risk reserve based on interproject performance trends

PROGRAM DIRECTION
- Track agency funding requirements
- Support S E B evaluations of technical and baseline feasibility
- Scope magnitude of agency wide risk reserves and budget request based on performance trends and funding uncertainty

The approach utilized to scope the requirements for these additional analytical capabilities may generically be described as Problem-Space analysis. Problem-Space analysis consisted of three principal activities, including data collection, problem definition, and user interviews. Data collection entailed a review of previous analyses concerning forward funding and the data bases currently available at DARPA to support potential solutions. The other two activities, problem definition and user interviews, were conducted iteratively as new perspectives gained through successive user interviews expanded and clarified the needs which must be addressed by potential solutions. Finally, at the conclusion of this iterative cycle, a preliminary assessment of the costs and benefits of alternative solutions was prepared.

The structure of the remainder of this document closely follows the activities and analyses which Meridian conducted as part of its Problem-Space analysis. Section 2.0 presents the results of the preliminary data collection, and includes a description of the existing system and supporting data bases. Sources of forward funding are then shown in relationship to the existing system. Section 3.0 is concerned with the analysis of potential solutions which were propounded as a result of the problem definition/user interview cycle. This analysis includes both ADP as well as non-ADP alternatives, and concludes with a general assessment of the relative costs and benefits of each. Finally, based upon this assessment, conclusions and recommendations relating to future analyses and system implementation are contained in Section 4.0.

2.0   DESCRIPTION OF EXISTING PROCESSES

The initial study team effort in addressing DARPA forward funding was familiarization with the DARPA managerial and administrative processes which relate to the problem at hand. Interviews were conducted with personnel from the Program Management Office (PMO), Technical Offices, Management Information Systems Division (MISD), Financial Management Division (FMD), and representatives of several Agents. These discussions served as the basis for the development of our understanding of the DARPA fiscal environment as represented in these pages. They also formed the framework from which our analysis is deriv .

We have segmented our view of the pertinent processes   lated to DARPA forward funding into four areas. These are characterized as:

o <u>Procurement</u> -- This category includes all activitit .formed in
   order to obtain the services of organizations to execute particular
   research efforts. The services may be obtained from either contrac-
   tors, universities, laboratories, or other government agencies and
   departments.

o <u>Program/Project Management</u> -- This group of activities represents
   all of the continuous technical, cost, schedule, and administrative
   monitoring which is performed to ensure compliance with contract,
   project, and overall program objectives.

o <u>Financial Management</u> -- This group of activities is concerned with
   the exercising of programmatic control over the flow of the DARPA
   budget.

o <u>Information Processing</u> -- This group of activities includes the
   steps taken to provide management data to DARPA Headquarters Staffs
   (PMOs and Technical Offices).

Section 2.1 discusses each of the four categories in detail and provides a graphic representation of the respective activities and information flows.

Our discussions with MISD and FMD also were concerned with the availability of management data which could be utilized to assist in the identification and resolution of forward funding problem areas. Section 2.2 discusses automated data bases which are currently maintained and other sources of related information.

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Section 2.3 provides a discussion of the relationship between the activities described in Section 2.1 and the occurrence of forward funding.

2.1   ACTIVITY FLOW

In this section, we will describe the DARPA management and information processing activities which are involved, either directly or indirectly, with the occurrence of forward funding. These activities are divided into four functional groupings which generally describe their purposes -- procurement, program/project management, financial management, and information processing. Figure 2-1 presents a graphic representation of all pertinent activities and their interrelationships. Figures 2-2 through 2-5 represent the specific sections of Figure 2-1 which deal with each of the four activity categories respectively. Each activity is enclosed within a rectangle and is identified with a code, such as "P2"; the codes are used in the following discussions to direct the reader to the corresponding activity in the figures. The lines between activities represent the flow of information and/or documents and are identified by circled numbers. In the textual discussions of each actitiy, all of the information/document flows are referenced by using the circled designations from the figures (these are placed in brackets). Numbers preceded by an "M" do not appear in the figure for the particular type of activity (2-2 through 2-5), but are displayed in the "master" chart (Figure 2-1). The figures are also segmented into columns to identify pictorially the organizational entities which perform each activ;ty.

Procurement (reference Figure 2-2)

Activity V1 -- Write Proposal

The formal initiation of the procurement process is the preparation of a proposal. This document describes the proposed work to be performed (SOW), schedule, costs, and other proposer-specific information.

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Figure 2-1

DARPA FORWARD FUNDING-RELATED PROCEDURAL REPRESENTATION

7
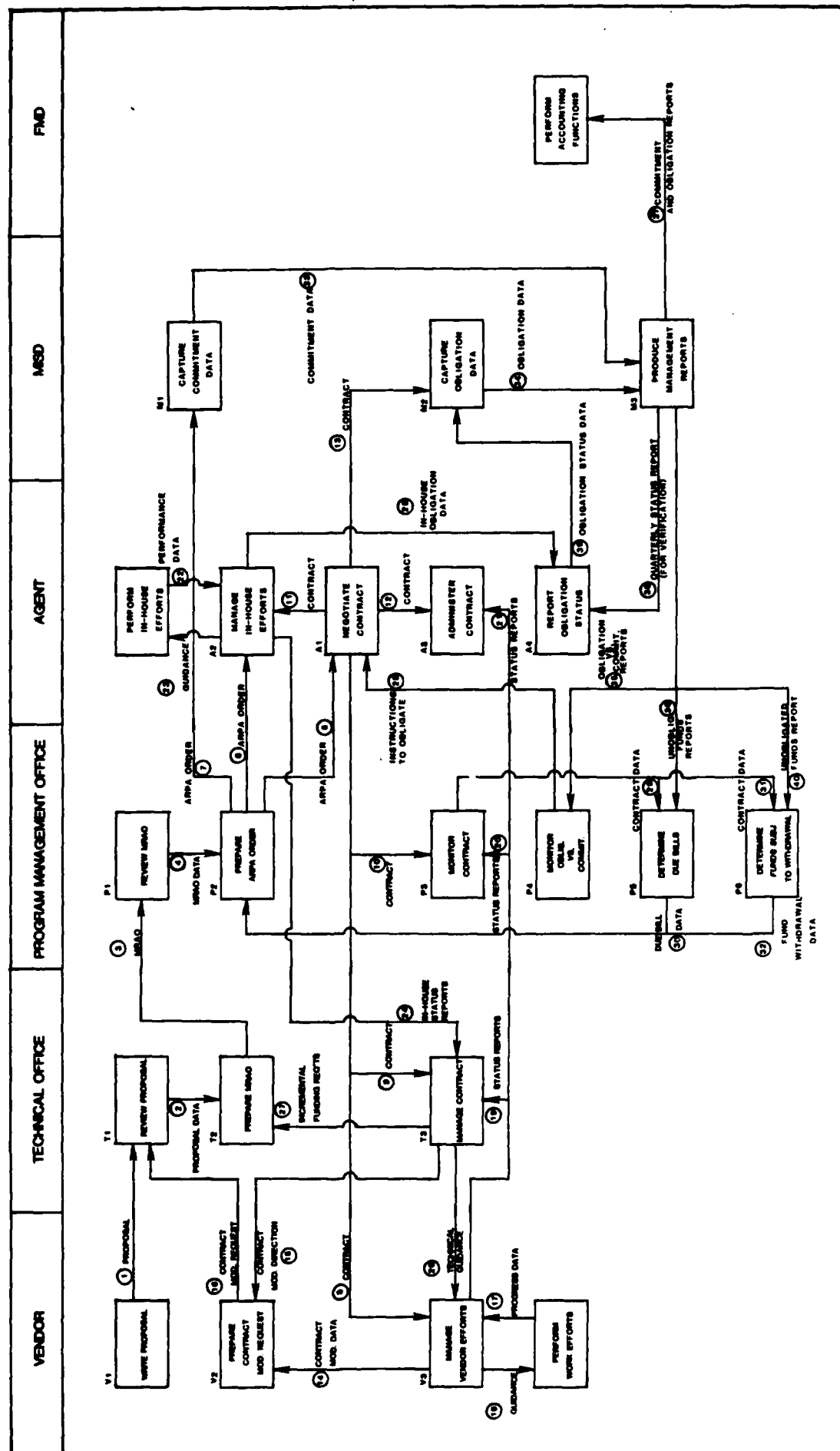
Figure 2-2

PROCUREMENT PROCESS
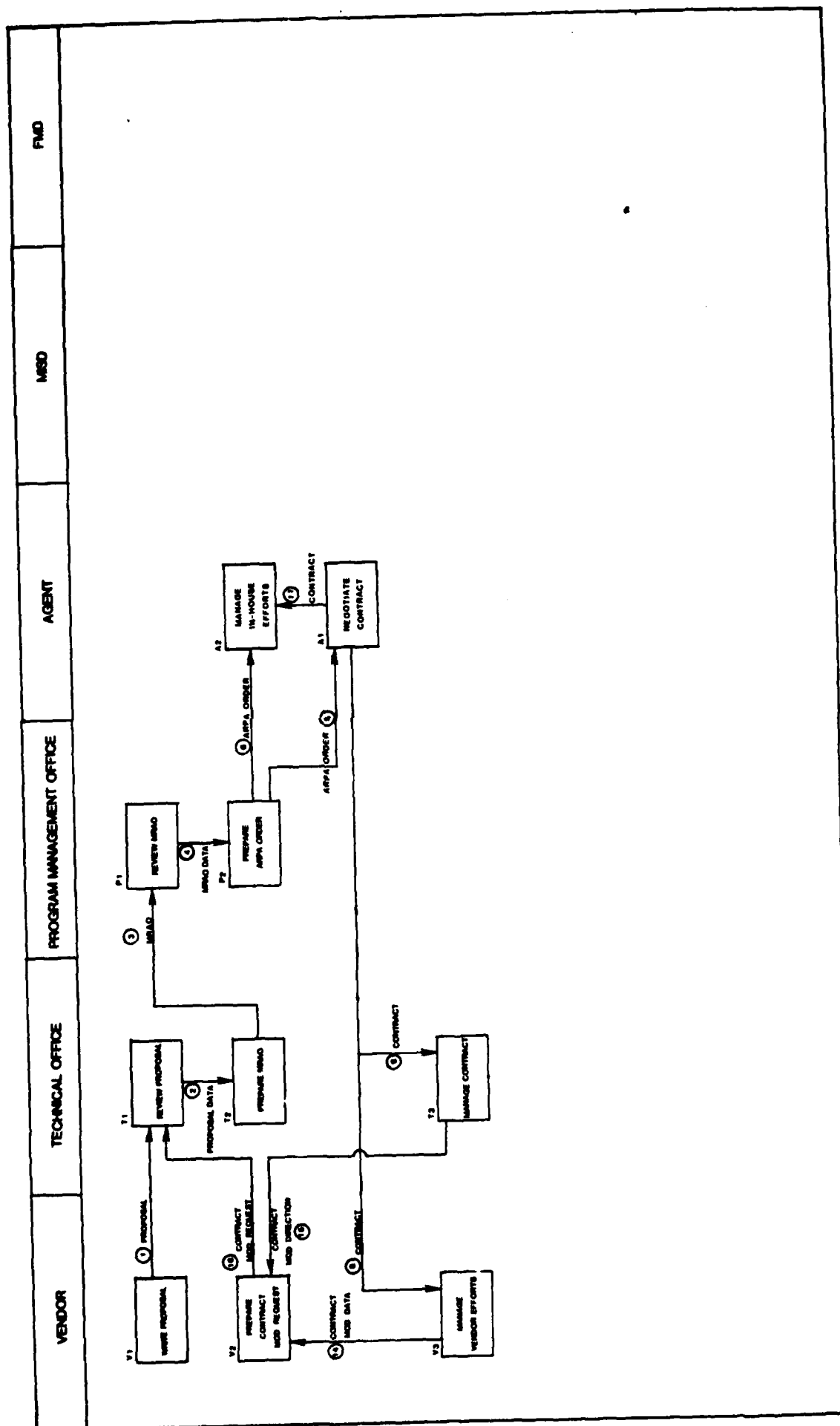
A proposal can be unsolicited (i.e., not specifically requested by DARPA) or may be in response to a statement of interest briefing. The vendor (contractor, laboratory or university) submits the proposal to the appropriate DARPA Technical Office for review [Information/Document Flow 1].

Activity T1 -- Review Proposal

Upon receipt of a proposal [1], the Technical Office will review said document in accordance with DAR 4-106.4 and will thereby determine if a subsequent procurement action is warranted. If a procurement is to be sought, information from the proposal and other supporting documentation will pass [2] to the next activity, MRAO Preparation. Requests for contract modification [16] are processed in a similar manner.

Activity T2 -- Prepare MRAO

When it has been determined that a procurement is warranted, a Memorandum Request for an ARPA Order (MRAO) will then be prepared. As specified in DARPA Instruction 13, MRAO's will address:

- o Funding profiles
- o Agent selection
- o Contractor information
- o Selected source justification
- o Reporting requirements
- o Security requirements
- o Statements of work
- o Other legal and administrative requirements.

Information from proposals and pertinent supporting documentation [2] will be incorporated where applicable. The MRAO will then be submitted to the appropriate Program Management Office (PMO) [3] for preparation

of an ARPA Order. Mini-MRAO's are prepared annually to present a con-
solidated listing of Technical Office funding requirements for incre-
mentally funded efforts. Mini-MRAO data [M27] is used by the PMO to
determine the upcoming fiscal year's due bills.

Forward funding may be initiated here in two separate and distinct
ways. First, the Technical Office may not match the funding profile
with the start date of the requested procurement. That is to say, if
a contract is requested to begin on the first of April, only six
months of effort requested should be funded out of the initial incre-
ment of funding. The second area where forward funding may arise is
when a Technical Office may request in-house Agent efforts and subse-
quently redirect the funds to other vendors and/or efforts.

Activity P1 -- Review MRAO

After a MRAO is sent [3] to a PMO, it is then reviewed for complete-
ness, accuracy, and appropriateness. If any questions arise, they are
resolved by interaction with the originating Technical Office. When
all aspects have been dealt with to the satisfaction of the PMO, infor-
mation from the MRAO, proposal, and other documentation is passed [4]
to the next activity -- Prepare ARPA Order.

Activity P2 -- Prepare ARPA Order

At this point, the PMO prepares the document which authorizes the
selected Agent to actually procure the services of a vendor on behalf
of DARPA or to perform in-house research. Information from preceding
documentation [4] is incorporated and funds are identified to pay for
the services. At this point (after signing), the funds are said to be
"committed". ARPA Orders are are also prepared to authorize contract

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amendments, commit funds for incrementally funded efforts, and withdraw unobligated funds. ARPA Orders are sent to Agents [5] to initiate directed or competitive procurements, and to initiate in-house studies [6]. ARPA Orders are also distributed to the Management Information Systems Division (MISD) [M7] where pertinent data is extracted and entered into an automated data base. Data is also passed to this activity from those dealing with due bills [M30] and funds identified for withdrawal [M31].

Forward funding may be initiated in this activity. As in Activity T2, the initial increment of funding may not be matched to the amount of money expected to be used in the current fiscal year.

Activity A1 -- Negotiate Contract

Upon receipt of an ARPA Order [5], the selected Agent will initiate steps to secure a contract. This may be through either a competitive process or direct negotiations with a specified vendor. Should the Agent obtain the required contractual services for a cost less than the ceiling imposed by the commitment specified in the ARPA Order, the savings revert back to DARPA. In practice, savings on multi-year contracts are usually not realized until the final year of the contract, thus resulting in a forward funding situation. This amount is relatively small, however, and is not believed to be significant by the study team.

When the contract has been finalized, the Agent distributes copies to the contractor [8], the Technical Office [9], the PMO [M10], and to internal contract administrators (if appropriate) [11, M12] for the purpose of contract management. A copy is also sent to DARPA MISD [M13] for obligation data input into the financial data base. Currently,

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there exists a problem with obtaining hardcopy confirmation of contract
award. Alternate and less accurate sources are thereby necessitated
which degrade the integrity of the data base. Internal DARPA actions
have been contemplated by PMO to alleviate this situation.

As a part of the financial management activities of the PMO, the amount
of funds obligated against each commitment (ARPA Order) is monitored.
If an Agent has not obligated the assigned funds in a timely manner,
the PMO will request that these funds be obligated without further delay.

Activity V2 -- Prepare Contract Modification Request

During the period of a contract, it may become apparent to the vendor
[14] and/or the Technical Office [15] that a contract modification is
warranted. In either case, a contract modification request is prepared
by the vendor. This takes a form similar to that of a proposal and
must contain all the technical and cost information [16] required to
enable Technical Office review and approval. A contract modification
request may be administratively channeled through the appropriate
Agent.

Program/Project Management (reference Figure 2-3)

Activity V3 -- Manage Vendor Efforts

This activity is performed by the vendor's management team and directs
the contractual effort in accordance with the terms of the contract
[8]. Contract performance data is input to this activity from the
work effort [17]. Specific outputs of this activity are work execution
guidance [18], contract status reports distributed to the Technical
Office [19], the PMO [20], and the Agent [21], and contract modification
initiatives [M14].

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Activity A2 -- Manage In-House Efforts

This activity is similar to Activity V3 and is executed to manage the in-house efforts performed by a particular Agent. The work is managed to the requirements of the ARPA Order [M6] and contract [11], performance data is obtained [22], guidance is provided to the Vendor in the performance of the work [23], and status reports are prepared and distributed to the Technical Office [24]. Obligation data is also passed to the obligation versus commitment reporting activity [M25].

Activity T3 -- Manage Contract

The appropriate Technical Office performs a technical oversight function [26] for each contract. Performance of contracts is monitored through periodic status reports [19] and managed to conform to the technical, schedule, and cost constraints imposed by the contract [9]. In-house Agent efforts are also monitored through periodic status reports [24]. If the Technical Office deems it necessary to pursue a modification to the terms of the contract, the vendor will be instructed [M15] to prepare and submit a modification request.

Information from this activity is also used to help determine the funds required for incrementally funded contracts (i.e., produce a Mini-MRAO [M27]).

Activity P3 -- Monitor Contract

The appropriate PMO also has oversight management responsibilities for each contract. These are of a more general and programmatic nature than those of the Technical Office. Information from the contract [10] and status reports [20] are used to assist in this activity. Information is passed from this activity to those dealing with financial

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Figure 2-3

PROGRAM/PROJECT MANAGEMENT PROCESS

management (determining due bill amounts [M29] and determining funds for withdrawal [M31]).

Activity A3 -- Administer Contract

As contracting officers for DARPA, Agents are required to ensure that the vendors conform to the administrative specifications of each contract [12]. Status reports [21] may be used in this activity. Contract modification requests may also be processed from the vendor to the Technical Office.

Financial Management (reference Figure 2-4)

Activity P4 -- Monitor Obligations vs. Commitments

After ARPA Orders committing funds for particular purposes have been executed, the PMO must continuously monitor the actions of the procuring Agents to make sure that the funds are obligated in a timely fashion. Information concerning the obligation of committed funds, by ARPA Order, is obtained in a report generated by MISD [35]. Each PMO can thereby identify ARPA Orders with unobligated funds and can contact the particular Agent(s) in order to rectify the situation [28].

Activity P5 -- Determine Due Bills

For multi-year contracts, the initial ARPA Order may only fund up to the end of the current fiscal year. For these contracts, the PMO must authorize (commit) incremental amounts of money each fiscal year. Information from the contract monitoring activity [29], MISD reports [36], and the due bill amounts are used to prepare the consolidated funding ARPA Orders [30]. This activity is another possible source of forward funding. As with the determination of the initial increment, if the PMO commits funds such that the cumulative funds expended by

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Figure 2-4

FINANCIAL MANAGEMENT PROCESS
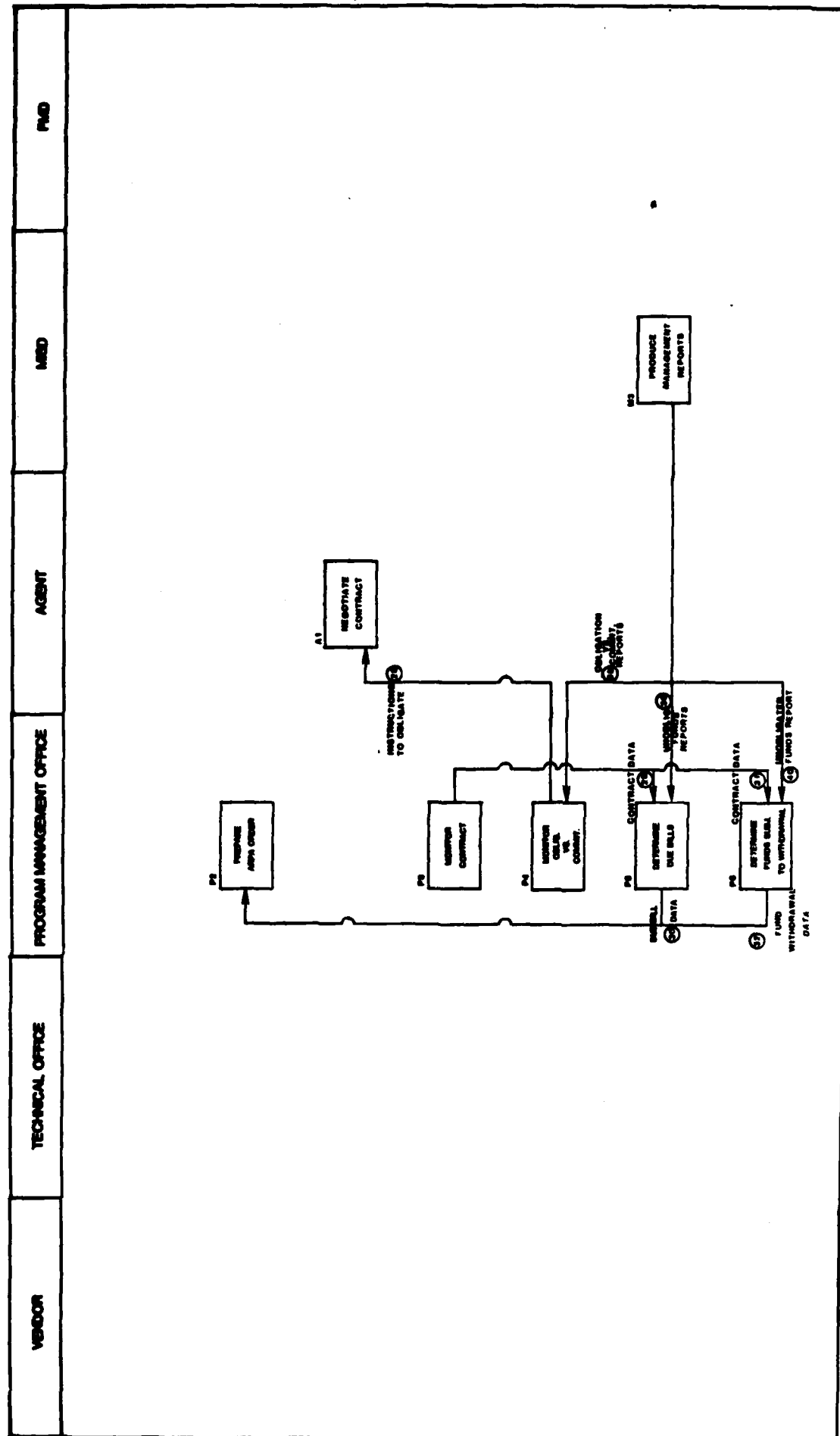
the end of the next fiscal year on a contract are less than the cumulative funds committed, forward funding occurs. For longer contracts, an ever-increasing "bow-wave" effect of forward funding may arise in this manner.

Activity P6 -- Determine Funds Subject to Withdrawal

For various reasons, it may become necessary to withdraw committed or, in extreme cases, obligated funds. Such reasons may be changed requirements, vital funding problems on other contracts, or the recapture of unused committed funds. The PMOs utilize information from the contract monitoring activity [31] and the unobligated versus commitment reports from MISD [40] and identifies funds to be withdrawn by an ARPA Order amendment [32].

Information Processing (reference Figure 2-5)

Activity M1 -- Capture Commitment Data

MISD extracts commitment data from each ARPA Order [7]. The data items captured are discussed in Section 2.2 and are used to produce various management reports [33].

Activity M2 -- Capture Obligation Data

MISD extracts obligation information from several sources (see Table 2-1) although the data is basically derived from the contract [13]. The unavailability of hardcopy contracts for all efforts presents a problem with data timeliness and integrity. Data is also obtained from Agents concerning obligation of funds [39]. The obligation data items captured are discussed in Section 2.2 and are used to produce various management reports [34].

Figure 2-5

INFORMATION PROCESSING PROCESS

TABLE 2-1

OBLIGATION SOURCES

o Contracts	o Financial Reports
o Grants	o Status Reports
o Purchase Orders	o Card II
o Signed ARPA Orders	o Memoranda
o Letters of Acceptance	

Activity M3 -- Produce Management Reports

Periodic reports are produced by MISD which present the status of DARPA
contract acquisition and funds expenditures. These reports reflect
commitment [33] and obligation [34] data and are used by the PMOs to
monitor commitments and obligations [35], determine due bills [36],
and identify funds for withdrawal [40]. Copies of obligated funds
reports are sent to each Agent for verification [38]. Reports are also
provided to the Financial Management Division (FMD) to assist their
accounting functions [37].

Activity A4 -- Report Obligation Status

Each Agent reports the amount obligated for each ARPA Order to MISD
[39]. This is used to assist in the extraction of obligation data,
particularly for in-house Agent efforts [25]. Each Agent receives a
report [38] of the data MISD has on file for its respective ARPA
Orders. The Agent then updates the report to reflect the current
obligation status and returns the report to the PMO.

2.2   AVAILABLE DATA

In addition to becoming knowledgeable of the processes by which DARPA
administers contractual research effforts, an objective of technical discussions

with persons involved with these processes was to identify available sources of information related to forward funding, since the analysis effort was constrained from the outset to employ primarily existing data sources. It became immediately evident that the most promising and accessible data source is the automated Fiscal Data Base currently being maintained by DARPA MISD. Data is captured primarily from hardcopy source documents and is maintained to produce on-line responses to queries and periodic standard reports. The stored data is segmented by type, the most relevant of which are listed in Tables 2-2 through 2-4.

These data sets are important to the problem of forward funding since they are already being captured and maintained, and, in general, solutions to problems based upon readily available data should be explored before implementing costly and time-consuming data collection efforts. The analysis team therefore concentrated on utilizing the data elements in the existing data base to identify and possibly quantify forward funding problems. The proposed use of these data elements is discussed in Section 3.1.

It should be noted that there are two areas of concern relevant to the data in the Fiscal Data Base, both revolving around the acquisition of obligation source documents. The first area of concern is timeliness -- Agents do not always report the obligation of funds without undue delays. This problem may be unsolvable due to the need for inter-Agency and inter-service coordination and directives. The second area of concern is that of accuracy, although it too is closely related to timeliness. Since hardcopy notification of contract awards often do not reach DARPA Headquarters as quickly as desired, other less reliable data sources have been accepted until superseded by more authoritative documents. It is critical to the ultimate success of any mechanism to control forward funding for DARPA to alleviate this problem. In the short run, as an added

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TABLE 2-2

ACTION DATA SET ELEMENTS

o ARPA Order Amendment Action (AAA)   o Vendor Phone Number

o Line Item Number   o Vendor Contact Name

o ARPA Order Code   o Contractor Selection Code

o ARPA Order Amendment   o Early Start Date

o Contract Number   o Award Date

o Contractor   o Start Date

o Fiscal Year   o Effective Date (not currently used)

o Program Code   o Funded To Date

o Office (Technical Office)   o Obligation Source

o Division   o Obligation Received Date

o Agent   o Hardcopy Received Date

o Funding Type   o DOD 1498

o Action Type   o Small Business Set-Aside Code

o Funds Committed   o Amendment Comments

o Funds Obligated   o AOPKG

o Funds Withdrawn   o WI

o FRO   o WP

o FCG   o WU

o ARPA Order Signed Date   o CREATFD

o ARPA Order Received Date   o UPDATFD

o Procurement Number   o UPDATER

TABLE 2-3

CONTRACT DATA SET ELEMENTS

o Contract Number

o Contract Type

o Previous Contract Number

o Contractor Name

o Contractor Class

o State

o Work State

o Country

o Agent

o Effective Date

o Expiration Date

o Contract Total

o MODFLAG

o CREATED

o UPDATED

o UPDATER

TABLE 2-4

CONTRACT MOD DATA SET ELEMENTS

o Contract Number

o ARPA Order

o Contract Mod Number

o Funds Obligated

o MOD APPR

o Funding Type

o Fiscal Year

o Program Code

o Program Element Numbers

o Award Date

o Start Date

o Effective Date

o Funded To Date

o Mod Received Date

o Obligation Source

o Contract Total

o Mod Comments

means of maximizing confidence in obligation data, all reports could be generated

which rely only those obligations with hardcopy obligation sources.

Contractor expenditure information, which could be useful in identifying

the existence of forward funding, is not currently being captured for all con-

tracts (the Performance Measurement System does include such data for some

larger contracts). If it should prove to be desirable to implement a data base

with expenditure information, the collection of data from status reports must

be addressed.

2.3   SOURCES OF FORWARD FUNDING

Based upon an analysis of the available data bases and the information

flows depicted in Figure 2-1, Meridian has identified several potential sources

of forward funding. Some of these sources may be characterized as inadvertent

or out of DARPA's control, others are more deliberate and therefore subject to

analysis and management scrutiny. At a minimum, analysis of existing data can

provide indications of which of these sources of forward funding is the probable

cause, and therefore such analysis can assist PMO in developing the appropriate

responses to perceived financial management problems.

The sources of forward funding identified by Meridian through the

process of requirements analysis included four primary causes. These are

labelled by Meridian as:

1) Excessive Initial Increment

2) Procurement Delays

3) Funding Redirectionn

4) Expenditure Lag

On any particular procurement, one or more of these phenomena may be

occurring. Consequently, the purpose of this section is to describe these

four sources of forward funding in greater detail and to identify how they

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might arise. Then, steps which DARPA can take to alleviate the impacts of these forward funding mechanisms will be analyzed in Section 3.0.

2.3.1   Excessive Initial Increment

This source of forward funding arises within DARPA, generally from the Technical Offices. As the label implies, an excessive initial increment is a commitment which cannot be or ought not to be expended by a contractor within the time allotted for the first phase of work. The reasons that excessive initial increments are sometimes authorized are varied. Occasionally, an initial increment may be larger than required due to optimism on the part of Technical Offices who, in preparing MRAOs, may make unrealistic assumptions about the time required to process ARPA Orders and negotiate contracts. Such optimism may or may not be detected by the PMO, who is responsible for minimizing forward funding through the implementation of the incremental funding directive. Alternatively, an excessive initial increment may be both deliberate and desirable. For example, if the total value of the contract is small and there are no significant discontinuities in the research effort, an excessive initial increment may be deliberately authorized to minimize the paperwork associated with processing contract modifications. While the merits of paperwork reduction may outweigh the inflexibility generated by the forward funding, this type of activity should at a minimum be recognized by PMO so that, if circumstances necessitate, appropriate actions can be taken to redirect program resources.

2.3.2   Procurement Delays

This source of forward funding is generally external to DARPA, and arises from the unpredictable amount of time necessary to prepare contract documents. The procedures used to prepare contract documents consist of several sequential steps, and a delay in any of them may adversely effect the

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critical path to contract award. Examples of uncontrollable procurement delay include typing backlogs, delays in legal analysis, lags in contract negotiations, etc.

The severity of procurement delays is largely dependent on the Agent and the magnitudes and complexity of the procurement. Understandably, the larger contracts require greater pre-award scrutiny, which increases the uncertainty associated with the processing time. However, over a period of time, analysis may indicate which Agents have historically been slow in consummating procurement actions. Such analysis would benefit DARPA insofar as it would permit better estimation of the time required for procurement and would provide more precise indications of the point at which agent delays become excessive. The first of these capabilities will assist DARPA in minimizing the likelihood of inadvertent excessive initial increments, while the second will provide Agent-specific flags to indicate instances where PMO intervention is warranted.

A special problem related to procurement delays is the occurrence of reporting delays. Reporting delays refer to the delay between the time when contracts are awarded by the Agent and the time when DARPA receives verification of the award. While DARPA has traditionally acknowledged a variety of obligation sources, the integrity of the data obtained from these sources is inconsistent at best. In fact, the only completely reliable source of obligation data is a copy of the signed contract itself. Until DARPA receives a copy of the contract, information concerning the procurement must be considered tentative. Unfortunately, there is frequently a considerable delay between the time of the obligation and the time at which DARPA can confirm the obligation. Consequently, totally reliable obligation data is not provided to DARPA in a timely manner, while information received from the less reliable obligation sources dilutes the integrity of the data base in toto.

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Strictly interpreted, the data integrity problem in general and the reporting delay problem in particular are not sources of forward funding. However, the existence of these problems must be recognized in utilizing forward funding analysis tools which rely on the existing data bases since these problems adversely impact the degree of credence which may be assigned to the system's outputs. At some point, problems associated with the robustness and timeliness of the data base must be resolved in order for a forward funding tracking system to gain believability and acceptance.

2.3.3 Funding Redirection

This source of forward funding is possibly the most difficult to detect. It refers to the process by which funds are placed with in-house laboratories or Agents with the intent to redirect the funds in small increments at a later time. This source often escapes detection since it is sometimes not possible to match the allocated funds to a specific statement of work. Also the appropriate level of funding for particular efforts may be difficult for a PMO to discern. If the statement of work is sufficiently broad or if the funds are sufficiently large, there exists tremendous potential for the inclusion of implicit or explicit contingency funds to accommodate changes in scope, ancillary analyses, or special projects.

While such redirections are not inherently bad or necessarily used for frivolous purposes, their very existence has profound implications for DARPA program management. Most importantly, the placement of funds for later redirection prevents PMO and the DARPA Director's Office from having complete knowledge of available resources which may be utilized to ameliorate agency-wide financial management problems. Moreover, although it provides greater flexibility to the Technical Offices, it also inhibits the ability of upper level DARPA management to make the inter-program trade-offs for which it is responsible. Consequently,

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the primary impact of this source of forward funding is a subtle yet fundamental shift in the locus of decision-making authority away from DARPA top management and to the Technical Offices.

2.3.4   Expenditure Lag

Expenditure lag represents an "after-the-fact" source of forward funding. It occurs when a contractor's actual expenditures lag substantially behind planned expenditures. Over the course of several months, underexpenditures can accumulate to the point where obligated funds may sustain the contractor well into the subsequent fiscal year. Analysis of expenditure lag can be used to identify funds available for redirection in the current fiscal year, or alternatively such analysis may identify opportunities for reducing due bills in later fiscal years.

The analysis of expenditure lag cannot be based strictly on extrapolation of existing expenditure trends. Rather, the analysis should be conducted with respect to the contractor's baseline plan, normative models of contract expenditure patterns, and the narrative supplied with the contractor's Cost Performance Reports. Much of this data should be available to PMO, although contractor's baseline plans are rarely used by PMO for contract monitoring, and Cost Performance Reports are received only sporadically. Improvements to data collection practices need to be initiated. However, normative models of contract expenditure patterns are being provided to the PMOs, and may be used in conjunction with these data sources to generate the report formats presented in Section 3.0.

3.0   ANALYSIS OF POTENTIAL SOLUTIONS

After having gained a basic understanding of the DARPA procedures and activities related to forward funding, the study team analyzed their findings to develop methods for identifying, quantifying and resolving forward funding problems. Identification of those actions which might be forward funded was addressed by developing report formats using Fiscal Data Base elements (see Section 3.1). These reports can be used to flag those contracts or inhouse Agent work efforts which have funds committed and obligated to them which will not be expended in the current fiscal year. Some of these reports can also be used to quantify the potentially forward funded amount. The reports are designed merely to be analysis aids and indicators of forward funding -- not to be solutions to the problems. The general procedures for using the information contained in the reports to resolve forward funding issues is addressed in Section 3.2. The development of specific methodologies for resolving forward funding problems are not attempted in this report, but rather should be performed in conjunction with analysis of live data in subsequent tasks.

3.1   AUTOMATED FORWARD FUNDING ANALYTICAL SUPPORT

The Meridian study team has developed several Fiscal Data Base report formats which could be used by PMOs to identify potential forward funding sources. These reports are not designed to quantify forward funding problems precisely, but rather to highlight exceptional situations which warrant direct attention. Each of the proposed report formats are producible from the existing Fiscal Data Base (with a few minor, noted data item additions) and are individually discussed below. A discussion of the issues involved with implementing these support tools is contained in Section 3.1.2.

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3.1.1 Solution Descriptions

Problem Area Number 1 -- Excessive Initial Increment

When a PMO prepares an ARPA Order for a new contract, he or she determines the amount of funding to be committed (and subsequently obligated). This amount may be for the entire contract or for an initial portion thereof. Funds that will be expended past the end of the current fiscal year are in essence "forward funded." Proposed Report Number 1 (see Figure 3-1) presents a means for identifying this situation. The report would list those ARPA Orders containing actions that have a "Funded to Date" past the current fiscal year. An estimate of the magnitude of the forward funding can be obtained by dividing the Committed Funds amount by the expected period of performance ("Funded to Date" minus "Anticipated Start Date"), and multiplying the result by the period of forward funded performance ("Funded To Date" minus end of current fiscal year date). This of course is a rough estimate and does not take into account any planned funding profiles other than straight-line.

This report could be generated directly from an ARPA Order (and supporting documentation) and could possibly be used to withdraw forward funded amounts prior to their obligation. The "Anticipated Start Date" is not currently being captured in the Fiscal Data Base, but is available on the ARPA Order and/or its accompanying document. The currently unused "Effective Date" of the Action Data Set could be utilized to store and access this date.

If it is not feasible to capture and utilize the "Anticipated Start Date" for Proposed Report Number 1, a similar report can be prepared from existing data. Proposed Report Number 2 (see Figure 3-2) would use the "Start Date" and "Funded to Date" from the contract (or other obligation source) in place of those dates from ARPA Orders. The estimate of forward funding would be computed in the same manner as described above. Since this report would not be generated until after funds have been obligated, the potential forward funding

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Figure 3-1

Proposed Report Number 1

EXCESSIVE INITIAL INCREMENT REPORT

FY 1984

Agent	AAA	Committed Funds	Anticipated Start Date[1]	Funded To Date	Estimate of Forward Funding[2]
AAAA	1012-032	100,000	10/01/83	12/31/84	20,000
	1012-034	200,000	06/01/84	09/30/84	---
	1012-035	1,000,000	04/01/84	01/31/86	727,272
	AO Total	1,300,000			747,272
	1115-047	500,000	10/01/83	06/30/85	214,285
	2320-132	2,400,000	01/01/84	01/01/85	600,000
	2320-133	100,000	01/01/84	03/30/85	20,000
	AO Total	2,500,000			620,000
	Agent Total	4,300,000			1,561,557
BBBB					

[1] This date is not currently being captured, but could be extracted from the ARPA Order (or possibly the MRAO) and stored in the "Effective Date" field.

[2] This number is computed by dividing the Committed Funds amount by the number of months in the expected effort ("Funded To Date" minus "Anticipated Start Date") and multiplying the result by the difference (in months) between the "Funded To Date" and the end of the Fiscal Year (09/30/84 in this case).

Figure 3-2

Proposed Report Number 2

EXCESSIVE INITIAL INCREMENT REPORT (FROM CONTRACT DATA)

FY 1984 DOLLARS

Agent	AAA	Committed Funds	Start Date	Funded To Date	Estimate of Forward Funding[1]
AAAA	1012-032	100,000	01/01/84	12/31/84	20,000
	1012-034	200,000	10/01/83	09/30/84	—
	1012-035	1,000,000	10/01/83	01/31/85	250,000
	AO Total	1,300,000			270,000
	1115-047	500,000	10/01/83	03/31/85	166,667
	2320-132	2,400,000	01/01/84	12/31/84	600,000
	2320-133	100,000	01/01/84	03/30/85	20,000
	AO Total	2,500,000			620,000
Agent Total		4,300,000			1,056,667
BBBBB					

. . .

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[1] This number is computed by dividing the Committed Funds amount by the number of months in the expected effort ("Funded To Date" minus "Start Date") and multiplying the result by the difference (in months) between the "Funded To Date" and the end of the Fiscal Year (09/30/84) in this case).

identified could not be easily withdrawn. This report could be used, however, to indicate incrementally funded contracts which could have due bills decreased.

Problem Area Number 2 -- Procurement Delays

Excessive Agent delays in procuring a contract may affect its period of performance and thereby induce forward funding. Proposed Report Number 3 (see Figure 3-3) would combine data from Reports 1 and 2 to display the impact on forward funding caused by procurement delays. All ARPA Orders which contain forward funded actions (as identified in Reports 1 and 2) would be displayed along with the estimates of forward funding as computed in the previous reports. The difference between the two estimates would then be that attributable to procurement delays.

Problem Area Number 3 -- Agent Reporting Delays

The timeliness of reported obligation data has continued to be a problem. Report Number 4 (see Figure 3-4) represents a means of identifying excessive Agent reporting delays. Any action for which the "Award Date" precedes the "Obligation Received Date" by more than a prescribed normal reporting period would be flagged. Since multiple obligation sources are accepted it would be possible to segment or arrange the flagged actions by source, thus depicting delays in obtaining the more reliable sources (such as contracts).

Problem Area Number 4 -- Funding Redirection

During interviews with DARPA personnel, it was learned that funds are occasionally committed before the specific usage of the funding has been determined. This seemingly is done to get the money "out the door" before it is reprogrammed to another office. It apparently takes the form of an ARPA Order to an Agent for generically described research. The Agent then does not

Figure 3-3

Proposed Report Number 3

AGENT FUNDED TO DATE CHANGE REPORT

Agent	AAA	Committed Funds	Funds Withdrawn	Obligated Funds	ARPA Order Estimate of Forward Funding[1]	Obligation Estimate of Forward Funding[2]	Procurement Effect on Forward Funding[3]
FFFF	1124-258	125,000	0	125,000			
	1124-259	500,000	0	490,000[4]	25,000	47,917	22,917
	AO Total	625,000	0	615,000	25,000	47,917	22,917
	1156-310	750,000	250,000	250,000[6]	—	62,500	62,500
	2213-493	150,000	0	145,000[4]	50,000	72,500	22,500
	2213-494	333,000	0	333,000	100,000	148,000	48,000
	AO Total	483,000	0	478,000	150,000	220,500	70,500
Agent Total		1,858,000	250,000	1,343,000	175,000	330,917	155,917
GGGG	•						
	•						

1 From Report Number 1.

2 From Report Number 2.

3 Difference between ARPA Order and Obligation forward funding estimates.

4 Indicates minor contract saving, possibly due to Agent's negotiations.

5 Indicates no "Funded To Date" change.

6 Indicates possible "banking" of funds.

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Figure 3-4

Proposed Report Number 4

AGENT REPORTING DELAY REPORT

Agent	AAA	Committed Funds	Obligated Funds	Obligation Received Date[1]	Award Date	Delay (In Days)[2]
QQQQ	3806-967	700,000	700,000	05/30/83	03/01/83	90
	3806-968	100,000	100,000	06/11/83	06/01/83	—[3]
	4538-009	1,800,000	1,700,000	06/01/83	04/01/83	60
	9867-348	406,000	406,000	05/15/83	01/31/83	105
RRRR	. . .					

[1] Some differentiation could be made concerning obligation sources such that only fairly reliable sources (such as contracts) would be considered.

[2] Computed by subtracting "Award Date" from "Obligation Received Date", only those that exceed a normal report period (perhaps 30 days) would be flagged.

[3] Indicates no reporting delay; this would only show up on a report if we choose to include all actions of an ARPA Order for which any action was reported late.

obligate the funds until given further instructions, thus redirecting the funding. One method of detecting such situations is currently being provided by MISD -- a report listing obligations and commitments by ARPA Order. This report is simulated in Report Number 5 (see Figure 3-5). Any ARPA Order which has funding that is unobligated for a long period of time should be examined for the possibility of future redirection.

Problem Area Number 5 -- Expenditure Lag

For various reasons, a contractor may not expend obligated funds as rapidly as is planned. For multi-year contracts, this may result in the commitment and subsequent obligation of incremental funding at least some part of which the contractor cannot expend in the intended fiscal year. Proposed Report Number 6 (see Figure 3-6) presents a method for detecting such situations by projecting the cumulative expenditures of a contract to the end of the fiscal year and comparing that number to the cumulative obligation. Those contracts with significant differences should be considered for reduced due bills for the next fiscal year. Care must be taken, however, to consider any accelerated expenditure plans which the contractor might have.

Unlike the other proposed report formats, this report cannot be produced without a significant data collection effort. Contractor expenditure profiles would have to be extracted from periodic status reports and entered into an automated data base. The implementation of such measures is addressed in Section 3.1.2.

Auxilliary Reports

The study team has developed two additional report formats which could be used to either augment the utility of other reports or to be used by themselves to indicate funding problems.

Figure 3-5

Proposed Report Number 5

UNOBLIGATED ACTION REPORT[1]

Agent	AAA	Committed Funds	Committed Date[2]	Unobligated Over 90 Days	Unobligated Over 120 Days	Unobligated Over 150 Days
CCCC	3101-096	250,000	10/01/82	250,000	250,000	250,000
	3101-097	350,000	10/01/82	0[3]	0[3]	0[3]
	3101-098	100,000	10/01/82	50,000[4]	50,000	50,000
	AO Total	700,000		300,000	300,000	300,000
	5112-145	1,500,000	02/01/83	1,500,000	1,500,000	-[5]
	7142-453	432,000	03/01/83	432,000	-[5]	-[5]
	Agent Total	2,632,000		2,232,000	1,800,000	300,000
DDDD	. . . .					

1 This report is currently being produced.

2 ARPA Order "Signed Date" in Action Data Set.

3 This indicates that these funds have been obligated.

4 Indicates partial obligation; this is not supposed to happen, but might.

5 Indicates that an action is unobligated, but for less time than the column cutoff.

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REPORT DATE: 06/30/83

Figure 3-6

Proposed Report Number 6

CONTRACT EXPENDITURE LAG REPORT

Agent	AAA	Current Contract Number	Funded To Date	Cumulative Contract Value	Last Report Date	Cumulative Contract Expenditures	Remaining Balance	Projected[2] Expenditures
ADDA	3472-124	A-83-324	09/30/83	1,000,000	05/31/83	723,145	276,855	100,000[3]
	3485-748	A-83-127	09/30/83	550,000	05/31/83	112,549	437,451	125,000[3]
	6012-098	D-83-520	06/30/84[4]	2,500,000	04/30/83	1,345,121	1,154,879	550,000[3]
	7651-447	F-83-142	09/30/83	2,200,000	05/31/83	958,252	1,241,748	475,000[3]
Agent Total				6,250,000		3,139,067	3,110,933	1,250,000

BEEB . . . .

1 Total of original contract, amendments and follow-ons.

2 Calculated by averaging expenditures over a given period and assuming a constant rate to the end of the fiscal year.

3 Indicates potential for decreased due bills.

4 Forward funding exists and should be taken into account.

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Funding Analysis Report (see Figure 3-7) displays a summary, by action item, of all funding activities. Threshholds could be established for flagging individual columns, such as over 10% unobligated or a combination thereof (e.g. commitments over $500,000 and over 5% outstanding). This report would indicate, among other things, the possible existence of funds to be redirected for future use.

Should an ARPA Order be identified as a possible forward funding source by any of the reports mentioned above, an historical record of all actions for that ARPA Order could be generated. This report (see Figure 3-8) could be used to help isolate the cause of the forward funding and would also be useful in identifying funds, such as an ever-increasing "bow wave" of forward funding.

3.1.2 Implementation Issues

For the most part, the development and implementation of the report formats described in the preceding section is straightforward and not expensive. It would consist mainly of finalizing the specific report structure, developing the desired report generation commands, and placing the report requests into the current job stream. For the few data items which are currently available but not maintained in the Fiscal Data Base, minor modifications to the data input procedures and the appropriate data base schema would be required. In the case of collecting, maintaining and extracting contractor expenditure data, more expansive and hence more costly efforts would be required. These activities would include:

o Development of measures to ensure comprehensive data collection

o Substantial data extraction and entry

o Development of a unique data base

o Development of report generation routines.

Figure 3-7

Proposed Report Number 7

FUNDING ANALYSIS REPORT

Agent	AAA	Committed Funds	Funds Withdrawn	Obligated Funds	Unobligated Funds[1]	% Unobligated[2]	Funds Pending Withdrawal[3]	Balance[4]	% Outstanding
AABB	1234-167	250,000	0	200,000	50,000	20	0	50,000	20
	1234-168	500,000	0	400,000	100,000	20	75,000	25,000	5
	AO Total	750,000	0	600,000	150,000	20	75,000	75,000	10
	7865-321	1,100,000	100,000	850,000	150,000	15	100,000	50,000	5
	8713-913	175,000	0	160,000	15,000	9	0	15,000	9
	8713-914	150,000	0	0[6]	150,000	100	0	150,000	100
	AO Total	325,000	0	160,000	165,000	51	0	165,000	51
Agent Total		2,175,000	100,000	1,610,000	465,000	22	175,000	290,000	14
BBCC	. . . .								

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1 Committed Funds minus Obligated Funds minus Funds Withdrawn.

2 Unobligated Funds divided by the difference between Committed Funds and Funds Withdrawn.

3 Those funds for which official de-committal process has begun.

4 Unobligated Funds Minus Funds Pending Withdrawal.

5 Balance divided by the difference between Committed Funds and Funds Withdrawn.

6 Indicates funds potentially to be redirected.

Figure 3-8

Proposed Report Number 8

ARPA ORDER HISTORICAL BACKUP REPORT

Agent	AAA	Amend. Number	FY	Committed Funds	AO Signed Date	Obligated Funds	Start Date	Funded To Date	Obligation Received Date
FFGG	2764-543	0	80	100,000	01/04/79	100,000	10/01/79	09/30/80	06/01/79[1]
	2764-544	1	81	150,000	05/15/80	150,000	10/01/80	09/30/81	09/15/80[1]
	2764-545	2	82	150,000	04/30/81	150,000	10/01/81	09/30/82	09/30/81[1]
	2764-546	3	83	150,000	03/31/82	120,000[2]	10/01/82	09/30/83	10/15/82[1]
	2764-547	4	83	-30,000[3]	12/20/82	--	--	--	--
	2801-102	0	83	750,000	06/01/82	500,000	10/01/82	09/30/83	09/25/82
	2801-103	1	83	-250,000[4]	06/01/82	--	--	--	--
	2901-241[5]	0	83	250,000	06/01/82	250,000	12/01/82	09/30/83	02/01/83
	3124-614	0	83	1,000,000	04/30/82	985,000[5]	10/01/82	09/30/83	08/15/82
	3124-615	1	83	300,000[6]	04/15/83	300,000	06/01/83	05/31/84[7]	07/27/83
	4002-112	0	83	200,000	05/15/82	200,000	10/01/82	09/30/83	10/10/82
	4002-113	1	83	0	04/30/83	0	--	02/29/84[8]	__[9]
	4107-111	0	83	400,000	06/20/82	395,000[5]	10/01/82	05/31/84[10]	10/10/82
IIJJ	. . .								

Notes explained on next page.

Proposed Report Number 8

ARPA ORDER HISTORICAL BACKUP REPORT

Notes:

1 Indicates consistently delayed reporting.

2 Indicates unobligated funds.

3 Indicates withdrawal of unobligated funds.

4 Indicates withdrawal of "banked" funds.

5 Indicates minor savings effected by Agent's negotiation.

6 Indicates additional funding (e.g., for increased scope).

7 Indicates forward funding.

8 Indicates "no cost" extension; also causes forward funding.

9 Indicates obligation has not yet been received.

10 Indicates excessive initial increment and forward funding.

4.0   CONCLUSIONS AND RECOMMENDATIONS

Having completed the preliminary requirements analysis/problem identification phase of the DARPA forward funding issue, the fundamental conclusion of the study team is that the next phase of solution analysis is warranted. This is based upon the findings of our studies which have shown that:

- o Forward funding exists and is generated by several actions.

- o Fairly uncomplicated, inexpensive means of identifying potential occurrences of forward funding can be implemented by generating reports using existing Fiscal Data Base information.

- o More involved measures are necessary to analyze other aspects of forward funding and should be assessed and if possible quantified in terms of costs versus benefits.

- o Simple methods and procedures by which PMOs and Technical Office program/project managers would be able to analyze reports and customize additional report and data base queries are warranted and should be explored.

It is therefore recommended that Phase II "Solution Space" analyses be initiated to perform the following:

- o Access live Fiscal Data Base records to assist in: a) finalizing report formats; and b) developing analytical processes and tools by which DARPA program/project managers can evaluate and respond to forward funding.

- o Develop alternative system development scenarios, the implementation of which could provide effective forward funding management information support.

- o Evaluate each system alternative in terms of development, implementation and maintenance costs versus the respective benefits provided.

- o Develop an analytical methodology by which program/project managers could systematically identify, analyze and take action on forward funding issues.

- o Develop a preliminary system design specification based upon the optimal system solution (as identified in the system alternative evaluation). Insight gained from the study of Fiscal Data Base records will, of necessity, play a vital role in specification development.

o Develop an implementation plan for the development of the recommended
   system alternative. Topics to be addressed include schedules, costs,
   training requirements, procedural impacts, and interface requirements.

In addition, the analysis of the Forward Funding Tracking System has

uncovered a much broader agency-wide need for increased coordination among

data bases and management planning and control systems. Toward this end,

Meridian recommends that the folowing additional activities be undertaken

during Phase II:

o Specify the interrelationships between the forward funding tracking
   system and other management planning and control functions.

o Define a methodology for planning and controlling the execution
   of major projects.

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