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*ORD*

ORD-810-80

13 AUG 1980

MEMORANDUM FOR: Chief, Development and Analysis Center
Office of Economic Research

STATINTL THROUGH:

NFAC ADP Control Officer

FROM: Philip K. Eckman
Director of Research and Development

SUBJECT: Joint OER/ORD Information Processing Project (U)

REFERENCES: A. OER memorandum dated 26 December 1979,
Subject: Request for Research Support

B. ORD-160-80, dated 25 February 1980,
Subject: OER Information Processing
Requirements

C. OER memorandum dated 17 April 1980,
Subject: Joint OER/ORD Information
Processing Project

1. This memorandum is provided as an interim response to the request contained in reference A. Two specific areas of support are identified in the reference. The first concerns computer support to OER's large economic data base. Since ▇▇▇▇▇ memorandum identifies a partial response to this problem by ODP, a coordination with that office is under way. Additionally, ORD has an active program to develop a digital optical disk storage system. This is briefly discussed below. The second concerns a possible interest in ORD's work in relational data base management systems. The next paragraphs discuss a project which addresses the two offices' mutual interests in this area. (AIUO)

2. It is this office's desire to have an evaluation performed of the utility of the relational data base management system, ORACLE, and the APL-like environment, APIS. In order to perform this evaluation ORD will loan a PDP-11/34 system to OER for the duration of the joint activity. The configuration of the system is:

SUBJECT:    Joint OER/ORD Information Processing Project (U)

       (1)  PDP-11/34 with 256K bytes memory
       (2)  RL-01 Disk Drives (@ 5.2M bytes each) with
           RL-11 Controller
       (1)  LA-120 DEC Writer III Keyboard/Printer
       (1)  Sanders Technology Media 12/7 Printer

ORD will acquire a TS-11 1600 BPI tape drive using OER funds to
be transferred to ORD for this purpose.  ORD will fund the main-
tenance contract for the duration of the joint effort.  ORD will
provide the following software:

       (1)  APIS software system including:
           ORACLE/UNIX data base management system
           UNIX operating system with utilities
       (1)  RSX-11M operating system
       (1)  ORACLE/RSX-11M data base management system
       (1)  "C" compiler for RSX-11M
       (1)  Pascal Compiler for UNIX

ORD will acquire an APL-11 Interpreter for the RSX-11M operating
system using OER funds to be transferred to ORD for this purpose.
(U)

   3.  The specific tasks for this evaluation are:

TASK 1 - Install and Evaluate the APIS Environment

   This task is as described in reference B.  It is requested
OER provide a written report to ORD summarizing OER's evaluation
of the environment with respect to its capabilities and system
performance.

   TASK 2 - Evaluate ORACLE

   This task is similar in scope to that described in paragraph
three of reference C.  Economic data base applications will be
implemented using ORACLE.  It is requested a written report be
provided that assesses this software's capabilities, utility, and
performance from the application developer's viewpoint and system
performance viewpoint.

   TASK 3 - Environment Extensions

   Based upon the results of the first two tasks, ORD will
prepare a proposal which considers possible extensions to the
software environments.  These may include the integration of APL-
11 with ORACLE, extensions to APIS for economic analysis, and
software migration to facilitate economic analyst access. (U)

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SUBJECT:  Joint OER/ORD Information Processing Project (U)

4.  In order to provide the consultative support required for tasks one and two and to prepare the proposal that is task three, ORD will contract with ██████████████, the developer of the APIS environment.  The contractor is also knowledgeable in the use of ORACLE.  Funds will be provided by OER for this purpose.  The allocation of the contractor support across the three tasks will be determined by OER's specific requirements.  All funds will be used in direct support of this joint activity and OER's concurrence will be required for the allocation of the funds. (AIUO)

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5.  The time required for these tasks is approximately nine months.  It is planned that the effort not exceed twelve months as no budgetary commitments have been provided beyond that period. OER's financial obligation for this period is:

- VT-100 Video Display Unit with APL character set   $ 3,000
- APL character set for LA-120   $   500
- TS-11 tape drive   $11,000
- "C" Compiler & Pascal Compiler   $ 1,480
- APL-11 interpreter   $ 3,450
- ██████████████ contractor support   $45,570 for approx. seven man-months (AIUO)

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6.  Of high interest to OER is support of very large data bases.  It is recommended this be pursued on a basis separate from the above project.  OD&E, ODP, and NPIC have expressed an interest in optical/video disk technology for digital storage and retrieval.  ORD is actively developing this technology for introduction to Agency environments.  An engineering development model is expected to be available for OD&E evaluation during FY81.  This technology should not be incorporated into the PDP-11/34 computer system without careful analysis.  While technically feasible to add such equipment to the minicomputer it does not follow that the computer system has the computational power to work the economic models using large amounts of data.  Therefore it may not be advisable to use the PDP-11/34 system beyond the planned tasks described above. (AIUO)

7.  Additionally, there is a need to establish a strategy for making any outgrowths from this effort available to the economic analyst.  As you know, analysts presently have available Ruffing Center (IBM technology) services.  The SAFE system may present a second technology base with which the analysts will work.  A third technology base (DEC) may not be advisable.  Hence

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*attachment A*

2 6 DEC 1979

MEMORANDUM FOR:   Dr. Philip K. Eckman
                 Director of Research and Development

FROM:            Acting Director of Economic Research

SUBJECT:         Request for Research Support

    1.  I would appreciate your help in identifying methods for implementing a very large computer storage system. The objective of the project will be to identify within six months a configuration of hardware and software that will satisfy OER's immediate and long-term requirements for a very large computer data base system, and that can be implemented by January 1981.

    2.  The problem this project will address is how to make effective use of the 20 billion bytes of machine-readable economic data that form the basis of much of OER's research and intelligence production. We now use computer tapes as our primary storage medium and the CROSSTABS software package as our primary data access method. With single jobs calling for as many as 40 tape mounts, the system is not very responsive. Worse still, deterioration of and damage to our 2300 reels of tape in the Ruffing Center force us to spend more time recreating data than we do analyzing them.

    3.  The Office of Data Processing (ODP) recognizes our problems with the tapes. They recently offered us disk storage for all our data, but on the condition that we find an acceptable means of storing and retrieving the data. We have two packages--APLDI and RAMIS--that are effective for data bases of more modest dimensions, but they cannot satisfy our requirements for the entire OER data base. We think that some of the developing relational data base management systems

SUBJECT: Joint OER/ORD Information Processing Project (U)

it is recommended that consideration be given to the migration of any desired tool (APIS, ORACLE, or other presently unavailable service) to the Ruffing Center or SAFE environments. In the near-term (two years) it may be preferable to limit the consideration of tool migration to the Ruffing Center. (AIUO)

8. Discussions with ODP are in progress to address mass storage requirements in the Ruffing and Special centers. Included in these conversations are the topics of systems software support for data access and the integration of special systems, such as optical disk systems, into these computer centers. It is this office's intent to keep OER apprised of progress in this area directed to addressing OER's needs. Because of the status of activities between ORD and ODP and the development of the optical disk system it is premature to identify a specific direction or schedule for resolution of OER's needs. As these activities develop a solution to OER's requirements will be specified.

9. As an aside, you may be aware that ORD is in the process of acquiring a VAX-11/780 computer system. This system is intended primarily as an image processing facility. A secondary function is to support work similar to the outlined joint effort. It should be possible to make this environment available to the Development and Analysis Center, via terminal, on a project basis. The VAX system will have the ability to support large data bases and will have special computational ability (e.g., array processors) such as that required for imagery work or large economic models. This topic should be pursued between the DAC/ OER and DPR/ORD. ▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮, Chief IPB/DPR, will assist you in this area. (AIUO)

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Philip K. Eckman

Attachments:
References A, B, and C

ADMINISTRATIVE-INTERNAL USE ONLY

and new storage hardware may be able to satisfy our require-
ments.  Knowing ORD is working in both these areas, we turn
to you for help.

    4.  Any help you choose to give us probably can be
subsumed in existing requirements.  In 1978 OER submitted
a request for the DDS&T to develop a machine storage
system, including software.  We most recently confirmed
this requirement in July 1979 to NFAC's Coordinator for
R&D Support and accorded the project our highest priority
in the data-handling category.  Messrs. ████████ and
████████ (extension ████) will be OER's technical
experts on the project. ████████

STATINTL

Distribution:
  Orig & 1 - Addressee
        2 - D/OER
        2 - DAC
  OER:DAC:████████:skf:20Dec79

ADMINISTRATIVE-INTERNAL USE ONLY

*attachment B*

ORD-160-80

25 February 1980

STATINTL

MEMORANDUM FOR: ████████████████

Chief, Systems Development Group
Office of Economic Research

THROUGH: AC/IPB/DPR/ORD

STATINTL   FROM: ████████████████

Data Processing Research
Office of Research and Development

SUBJECT: OER Information Processing Requirements

REFERENCES: ORD-093-80, dated 28 Jan 1980, subject
Research Support; and D/OER's memorandum,
dated 26 Dec 1979, subject Request for
Research Support

1.   Background

Director, Office of Economic Research, has requested
ORD to assist in the analysis of OER's information proces-
sing requirements.  C/IPB has assigned this project to me.
Consequently, I met with you and your staff members to
discuss concepts and alternatives for investigating feasible
solutions to support OER's information processing require-
ments.  This memorandum suggests an initial approach to
analyzing and developing tools for exploring OER's informa-
tion processing requirements.

The Office of Economic Research is tasked with ana-
lyzing very large amounts of raw economic data in order to
prepare finished intelligence on trade, GNP, productivity
and economic activity (among other topics) of all nations of
interest to the United States.  Generally, this task requires
the analysis of many large ($>10^{10}$ bits) economic data bases.
This analysis involves the development, application and
interpretation of many complex economic models to the avail-
able data in order to derive finished intelligence.  In many
areas, OER possesses the only expertise capable of dealing
with the problem.

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SUBJECT:   OER Information Processing Requirements

2.   Objectives:

This memorandum proposes Phase I of the development of
an advanced research tool for OER analysts.  This tool is
intended to meet several criteria:

      a.   provide OER analysts with an integrated
analytical tool (e.g., APL) which is capable of
directly accessing the various econimic data bases;

      b.   provide OER analysts with simple, unparal-
leled access to data without resorting to the neces-
sity of interfacing with a programming specialist;

      c.   provide online access to OER analysts for
economic data bases totaling over 20 billion bytes of
data.

      The development, implementation and evaluation of this
research tool will be accomplished in two phases:

      o phase I - A Personal Computing Facility
      o phase II - An Archival Data Base Facility

3.   Personnel and Organizational Components

STATINTL            ██████████ - ORD/DPR
                        OER/SDG
      OER Staff Members
      ORD Contractors
      ODP Staff Member

4.   Funding:

Funding for Phase I will be provided by the Office of
Economic Research according to the tasks outlined in section
7.  The initial cost for phase I hardware/software--A Personal
Computing Facility--is estimated to be $48,000.  These funds
will be used to provide a personal computing system with
associated software and to provide initial contractor support
to assist OER in software development.  Additional funding,
to be supplied by OER, will be required for software integra-
tion and development tasks once the personal computing
facility testbed has been installed and evaluated by OER.

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SUBJECT: OER Information Processing Requirements

Total funding for Phase I is estimated to be $60,000.
This estimate is obtained as follows:

o Hardware                                    $35,000
  (does not include tape
  drive and video display
  units)

o Software                                    $13,000

o Supplementary contractor
  effort                                      $12,000
                                              $60,000

During phase II--An Archival Data Base Facility--
OER/ORD personnel and contractors will investigate the
availability of optical disk technology for archival storage
of digital information. Several manufacturers are actively
engaged in prototype development of archival storage facili-
ties based on optical disk technology. Among these are
Magnavox Government and Industrial Electronics Co., an IBM-
MCA Consortium, and XEROX Electro-Optical Systems Division.
A subsequent memorandum will propose the tasks to be per-
formed in Phase II.

5. Phase I - Hardware

A minicomputer system of the PDP-11/34 class is suggested
for this project. This minicomputer system can support
multiple, sequential users and will execute APL-11 with
ORACLE/RSX or the Agency Personal Information System. The
configuration of the system is shown in the table below.

Item

o PDP-11/34 Packaged System includes:

  (2) RL-01 Removable Disks (@5.2MB each)
      LA-36 Console Printer (@9600 Baud)
      256K bytes memory
      Line Frequency Clock
  which is packaged in one 72" high Cabinet

o Sander's Media 12/7 Typographic Printer
o DZ-11 Asynchronous Multiplexor (8 lines)

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SUBJECT: OER Information Processing Requirements

The cost of this system, estimated to be $35,000, is based on the list price of the PDP-11/34 given by Digital Equipment Corp. The FY-80 GSA Schedule will provide the government with several discounts for the equipment mentioned above. At least a 10 percent, and possibly more, discount will be applicable to this equipment. An additional discount is available through the contractor for the Personal Computing Project due to the large volume of business it conducts with Digital Equipment Corp.

The PDP-11/34 system is configured for an office environment. It is anticipated that this machine will be installed in OER's Development Analysis Center. I suggest that a magnetic tape drive for system checkpoints should also be procured by OER. Video display units will be furnished by OER. These may be attached to the system through the DZ-11 multiplexor. OER must also obtain a maintenance contract, estimated at $3,200 per year, for the equipment.

6. Phase I - Software

In Phase I, two software systems will be provided for experimentation in the personal computing environment. These are the RSX-11M and the Agency Personal Information System.

Additional software must be acquired to accomplish several tasks related to economic analysis.

The UNIX operating system is the basis for the Agency Personal Information System (APIS). APIS will include the ORACLE/UNIX relational data base management system, a document preparation system interfaced to the Sander's typographic printer and a wide variety of UNIX utilities. The cost of a UNIX license (version 6) is $6,700. The cost of ORACLE/UNIX is $2,000.

RSX-11M is the standard operating system for the PDP-11/34. Its cost is "bundled" into the price of the hardware. OER will need to acquire the following software items for compatibility:

o an ORACLE/RSX license at $2,000
o a "C" Language Compiler for RSX-11M at $1,000

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SUBJECT: OER Information Processing Requirements

In addition, many OER analysts make extensive use of APL to develop models and solve economic problems. APL-11 is available under RSX-11M for a one-time license fee of approximately $3,000.

7. Phase 1 - Project Tasks

This project is involved in developing new approaches to designing and processing very large economic data bases within the Office of Economic Research. The minicomputer system will serve as a testbed for pursuing new methods in organizing, storing, retrieving and processing economic data bases.

The ORACLE relational data base management system offers a simple tabular view of data while making it accessible to nonprogrammers through a nonprocedural, English-like query language. This system offers OER potentially substantial benefits in the way it organizes and manipulates data.

The tasks to be accomplished in Phase I are described in the following paragraphs. These tasks are intended to elicit the maximum utility and benefit to the Agency with regard to the processing of very large economic data bases.

In phase I, the objective of this project is to examine the use of a personal computer in the economic analysis environment.

TASK 1 - Install and Evaluate Personal Computer

A Personal Computer will be installed in OER/DAC spaces. This system will run the APIS software and RSX-11M with ORACLE/RSX and APL-11. OER/DAC will utilize the personal computer system to prepare documents, develop computational models and manage data. OER analysts will be instructed in the use of APIS software and asked to evaluate its utility to their working environment.

Estimated Effort: 6-9 months/OER Personnel

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SUBJECT: OER Information Processing Requirements

TASK 2 - Develop Data Base Designs for Very Large
Economic Data Bases

OER conducts analysis on several very large economic
data bases (~10-20 GBytes). This analysis is conducted
using both sequential (examining all records) and adhoc
(examining random records) methods. Data base structure is
crucial to the efficiency with which very large data bases
can be processed since any system will be largely I/O bound.
The complexity of these economic data bases varies consid-
erably. Different analysts will require different views and
organizations of the data base to support their analysis.

Economic data bases would be implemented, stored, and
retrieved using the ORACLE relational data base management
system. ORACLE offers simplistic, flexible and easy access
to a data base; so much so that we expect OER analysts to be
able to ultimately design and create their own data bases.
Nevertheless, there remain several questions of access
efficiency related to data base design which should be
explored in this project. This task requires the services
of a data base expert to assist in data base design evaluation.

Estimated Effort: 2-3 months/ORD Contractor,
1-2 months/OER Personnel

TASK 3 - Integrate APL-11 with ORACLE

An essential analytical tool which is used by OER
analysts is APL. OER has recognized the efficacy of util-
izing APL with a data base management system. No current
facility exists within RSX-11M. This task will develop an
interface between APL-11 and the ORACLE data base management
system by developing and integrating with APL-11 a set of
modules which allows an APL user to directly access the data
base. As APL-11 is written in PDP-11 Assembly language,
these modules will be written in MACRO-11 to interface with
ORACLE. The expert services of a PDP-11 programmer will be
required.

Estimated Effort: 2-3 months/ORD Contractor

SUBJECT: OER Information Processing Requirements

TASK 4 - Develop Testbed Economic Data Base

Using a subset of the UN Data Base, a testbed economic data base will be implemented and tested under the ORACLE Relational Data Base Management System. The ORD Contractor will work closely with OER personnel to train them in using the ORACLE system to manipulate and manage data. Using the results of Task 2, several data base designs will be implemented and evaluated for efficiency. OER analysts will work with these data base designs to determine their impact upon the user's perception of the data.

Estimated Effort: 4-6 months/OER Personnel,
1-2 months/ORD Contractor

TASK 5 - Extensions to APIS for Economic Analysis

During the APIS evaluation period, it is quite likely that OER Personnel will determine additional features to be added to the APIS system software. Specific features will be discussed with the ORD Contractor and the COTR in order to decide which ones shall be designed and implemented. Any extensions will be developed to have as great a utility as possible for other potential users in addition to satisfying OER's needs. It is not possible to estimate the effort required to develop these extensions. Additional funding will be required to support the contractor during development of these extensions.

TASK 6 - Phase II Planning

OER Personnel and the Project Officer will develop a detailed project plan for Phase II efforts. Phase II will involve evaluation and acquisition of an optical disk mass storage facility for storing large economic data bases. Because of the proprietary nature of the technical data involved in this task, no contractors will be included in the planning team. Most optical disk systems surveyed to date are interfaced to a PDP-11 family computer. Thus, this plan will provide an approach for evolutionary progress from Phase I.

Estimated Effort: 1 month/OER Personnel, ORD
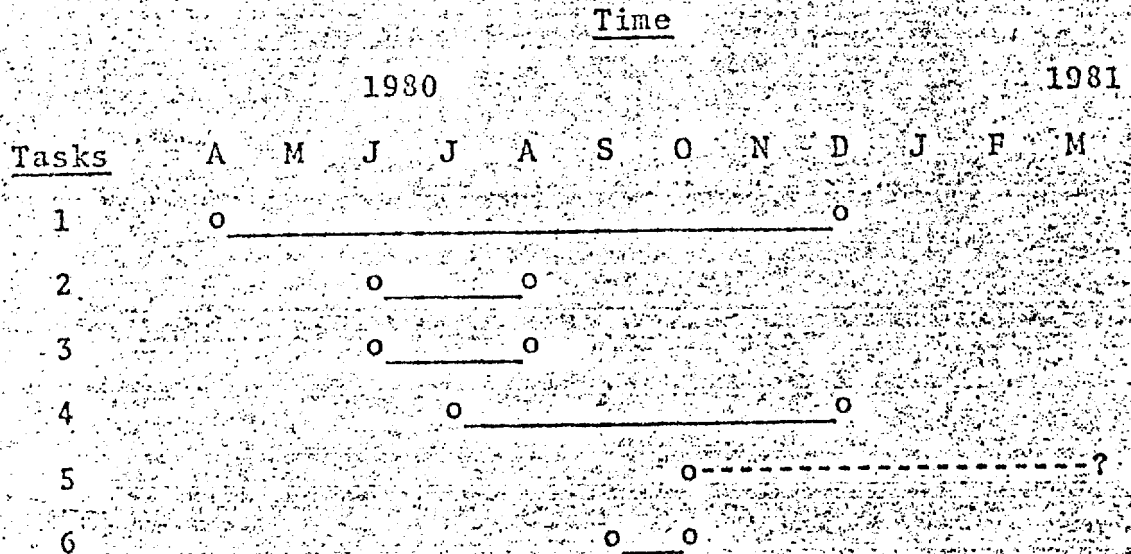Project Officer

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SUBJECT: OER Information Processing Requirements.

8. Scheduling

It is anticipated that a personal computer system could be provided to OER in early third quarter, FY-80. However, this installation is contingent upon transfer of appropriate funds to ORD. The following schedule is based on the installation of the personal computer. Several of the tasks may be executed concurrently.

| Phase | Task | Effort (Months) | Start Date |
|-------|------|-----------------|------------|
| I | 1 | 6-9 | Apr 1980 |
|   | 2 | 2-3 | Jun 1980 |
|   | 3 | 2-3 | Jul 1980 |
|   | 4 | 4-6 | Jun 1980 |
|   | 5 | ? | Oct 1980 |
|   | 6 | 1 | Sep 1980 |

Time

| | | 1980 | | | | | | | | | | 1981 | |
|-------|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tasks | A | M | J | J | A | S | O | N | D | J | F | M |
| 1 | o | | | | | | | | o | | | |
| 2 | | | o | o | | | | | | | | |
| 3 | | | o | o | | | | | | | | |
| 4 | | | | o | | | | o | | | | |
| 5 | | | | | | o | | | | | | ? |
| 6 | | | | | o | o | | | | | | |

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SUBJECT:   OER Information Processing Requirements

Distribution:

  Orig - Addee
    1 - DD/ORD
    1 - DPR Chrono
    1 - AC/IPB Chrono
    1 - D/ODP - FYI
    1 - ORD Registry

STATINTL   ORD/DPR/DD/S&T/ ████████ : ████████      STATINTL

17 April 1980

MEMORANDUM FOR:  Director, Office of Research and Development

FROM:            Chief, Development and Analysis Center, OER

SUBJECT:         Joint OER/ORD Information Processing Project

REFERENCE:       ORD-160-80, dated 25 February 1980,
                 Subject:  OER Information Processing
                 Requirements

     1.   Thank you for your response to our request for help with
our information processing requirements.  We would like to go
ahead with the project you proposed.  OER approved the project
and will provide the money.  Our administrative staff is drawing
up the papers for the funds transfer (see Attachments).

     2.   The total amount to be transferred is $65,000.  We under-
stand we will receive the following in return:

          -- Hardware

               -One PDP-11/34 as described in paragraph 5
                of the reference.
               -One Sanders Media 12/7 Printer.
               -One DZ-11 Multiplexer (8 lines).
               -One 800/1600 bpi tape drive.
               -One APL/ASCII video terminal.

          -- Software

               -A UNIX license.
               -An ORACLE/UNIX license.
               -An ORACLE/RSX license.
               -A "C" language compiler (RSX-11M version).
               -An APL-11 license (RSX-11M version).

          -- Other

               -A one-year maintenance contract for the entire system.

-- Other (continued)
  -Additional hardware, software and contractor
  services in support of the OER project in the
  amount of $49,000. (We assume ORD will spend
  at least 70 percent of the $65,000 transferred
  in support of the OER project.

3.  We are planning to do much of the development work pro-
posed for this project on "live" economic intelligence problems,
to help produce finished intelligence.  For example, we plan to
develop the following:

> -- An interactive data base of information on inter-
> national arms transfers.  We will evaluate primarily
> the analytical and presentational software by attempt-
> ing to produce "camera-ready" tables directly from
> the data base, and to integrate the tables with the
> text for our Trade and Aid Branch's annual intelli-
> gence handbook called Communist Aid to Less Developed
> Countries of the Free World.

> -- An interactive system of petroleum engineering
> data.  With this application we will evaluate the
> ORACLE software by attempting to build a complex
> network of reservoir engineering data for our
> Petroleum Supply Analysis Center.  We will further
> evaluate the presentational software by attempting
> to compile complex data input streams from the data
> network to drive resource planning models.

4.  We have already profited greatly from working with ORD
to get this project started and are anxious to get on with the
work.  Please let me know if there are any problems in starting
work immediately.  You should be notified of the funds transfer
shortly.

STATINTL

Chief
Development and Analysis Center
Office of Economic Research

Attachment:
as stated