

DOE/NV/11417-2

**GREAT BASIN PALEOENVIRONMENTAL STUDIES PROJECT
TECHNICAL PROGRESS REPORT
SECOND QUARTER
(September - November, 1993)**

**DESERT RESEARCH INSTITUTE
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submitted to
**U.S. Department of Energy
Yucca Mountain Site Characterization
Project Office
Las Vegas, Nevada**

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DOE

PALEOBOTANICAL STUDIES IN THE GREAT BASIN

Dr. Peter E. Wigand, Principal Investigator

Project Goals:

The goals of the paleobotanical studies are to 1) reconstruct the response of vegetation at the community and the organismal levels to climate in order to identify periods of mesic climate at Yucca Mountain and the adjacent region during the last 20,000 to 50,000 years. This is being achieved by integrating data obtained from nearly continuous sediment records of pollen (and the stable isotope analyses obtained from the pollen), and 2) plant macrofossils, pollen and stable isotopes from fossil woodrat middens.

These data will be used to identify periods of much more mesic climate, and provide information that can be used to estimate the magnitudes and durations of rainfall shifts by reference to modern distribution, characteristics and ecophysiology of analogous plant communities and/or indicator species. Of particular importance is determination of the amounts, and actual period of availability of excess water during these periods. These estimates, in combination with those derived from ostracode and diatom analyses conducted by the USGS will provide reasonable indications of variations in climate that can be used to reconstruct past extremes in infiltration rates that may serve as estimates of those that may be expected during the next 10,000 years at Yucca Mountain.

Progress on Tasks:

Palynological:

Task 1 Extend the present 4,000 year long vegetation history record from Lower Pahranagat Lake, southern Nevada for the purpose of providing baseline data for the generation of transfer functions for interpretation of less complete Pleistocene paleoclimatic proxy records. Lower Pahranagat Lake also provides the eastern terminus of a network of sites that straddle the Nevada Test Site and Yucca Mountain. As such it will establish the regionality of any climate patterns that are revealed.

Progress: *The present 4,000 year long vegetation history record from Lower Pahranagat Lake, southern Nevada has been sampled more intensively for pollen and radiocarbon dates to add detail and precision to the present record and resolve rates of climate change and vegetation response. In addition, ostracode samples have been submitted to Dr. R. Forester of the USGS to correlate the terrestrial data to the lacustrine data.*

Task 2 Assembly of a modern plant community pollen data base.

Progress: *Assembly of modern plant community pollen data base is an on going effort. We will be setting out passive pollen traps this winter (now that the pollen production has ceased for the year) near established weather stations so that modern weather data can be tied directly to the pollen record. The transect will stretch into the northern Rockies. These data are further aided by the data base of modern surface pollen samples compiled and submitted for publication by Dr. Owen Davis of the University of Arizona.*

Paleobotanical (Continued)

Task 3 Assembly of available palynological data from the Intermountain West into a data base, including the augmentation of the data from some of the localities previously examined by us in order to accomplish the goals of the project. This includes the submission of radiocarbon dates and tephra analyses for the resolution of chronologies, and analyses of pollen samples taken at closer intervals to resolve the rates of climate change, their magnitude and the response of the vegetation community.

Progress: *Assembly of available palynological data from the Intermountain West into a data base is proceeding. In addition, we are putting it into a format conforming with the guidelines followed by the National Geophysical Data Center. We have recently talked to Dr. D. Adam at the USGS in Menlo Park, CA about an exchange of data that will further our mutual goals.*

Task 4 Coring of selected southern Nevada localities for paleoenvironmental records.

Progress: *The requisite state-wide and local permits have been obtained from the BLM and the Fish and Wildlife Service for the coring of selected southern Nevada localities for paleoenvironmental records. Three localities, Pahrump Playa, Stewart Playa, and Peter's Playa, have been cored. Although we have cored in the Eagle Lake area of northeastern California and intend to use some of that data in our final analyses, we are putting off any further coring in the south until the spring.*

Paleonidological:

Task 5 Assembly of available woodrat midden data from the Intermountain West into a data base.

Progress: *Assembly of available woodrat midden data from the Intermountain West into a data base is on going. We are in correspondence with other investigators in an attempt to fill in gaps in the data where necessary.*

Task 6 Process samples already collected that are pertinent to the goals of the project.

Progress: *Sample previously collected from the Pahranagat Range of southern Nevada have been processed. Some 30 plus radiocarbon dates have been run and the plant materials are being sorted and identified. Stable isotopic samples will be run in the near future. Insect remains have been sent to Dr. S. Elias, a subcontractor, for identification and analyses.*

Paleobotanical (Continued)

Task 7 Collection of modern vegetation and climate data pertinent to interpretation of woodrat midden data in an analogue/nonanalogue manner.

Progress: *Collection of modern vegetation and climate data pertinent to interpretation of woodrat midden data for use in analogue/nonanalogue comparisons is on going. These localities correspond, in as much as is possible, with the pollen collection localities mentioned above.*

Task 8 Select, collect and process new midden localities that are pertinent to the goals of the project.

Progress: *New localities in southern and central Nevada have been selected, collected, processed, radiocarbon dated and analyzed. These localities are adjacent to localities that are being or have been cored for pollen and ostracode records.*

Problems Encountered:

We are still waiting upon the resolution of an application made to the Air Force to core at several sites in southern Nevada. The Yucca Mountain project office has provided a clarification of our status with regards to collection of cores outside of the Yucca Mountain area.

PALEOFAUNAS
Dr. Stephanie Livingston, Principal Investigator

Project Goal:

The goal of this study is to construct a history of Great Basin vertebrates, particularly mammals, that will provide empirical evidence of past environmental and climatic conditions within the Great Basin as it is recorded by the animals. Taxonomic composition of archaeological and paleontological faunas from various areas within the Great Basin and morphological change within individual mammalian taxa at specific localities are being investigated to monitor faunal response to changing environmental conditions. Data are being obtained from published records, modern museum specimens, and raptor pellets to provide a modern control to which the paleofaunal data can be compared. This study will provide an independent set of surrogate data for use in building a model of past conditions and assessing the effects of past climate change on various aspects of the environment.

Progress on Tasks:

Task 1 Data collection from existing paleo- and modern-vertebrate collections.

Progress: *Data collection continues from the Floating Island Cave assemblage, and has been initiated from the Homestead Cave assemblage. Metric data from modern collections of Neotoma and Thomomys have been collected for control of clinal variation.*

Task 2 Field recovery of modern, archaeological, and/or paleontological vertebrate materials.

Progress: *Coring was conducted at the DeLong Locality for a stratigraphic sequence from which a continuous paleomagnetic record could be obtained for use in correlating the signals from the bone bearing deposits, thereby providing age estimates for the faunal materials.*

Task 3 Dating and other special analyses.

Progress: *Analysis of the core taken at the DeLong Locality for chronological control is being conducted at University of California, Bakersfield under subcontract with Dr. Robert Negrini.*

Problems encountered:

No specific problems have been encountered.

GEOMORPHOLOGY

Dr. Nicholas Lancaster, Principal Investigator

Project Goal:

The objective of the geomorphology component of the paleoenvironmental program is to document the responses of surficial processes and landforms to the climatic changes documented by studies of packrat middens, pollen, and faunal distributions. This major objective will be achieved by a variety of projects designed to reveal the linkage between climate change and physical response. The project will focus on: (1) stratigraphic relationships between lake deposits and aeolian or fluvial sediments and landforms; (2) cut and fill sequences in floodplain and river-channel deposits; (3) identification of periods of dune mobility and stability; (4) documentation of episodes of alluvial fan and terrace development and erosion; and (5) correlation of (3) and (4) to climatically driven lake-level fluctuation as revealed by shoreline features such as strandlines and beach ridges. Numerical and relative dating of geomorphic events will be accomplished by a range of techniques including C^{14} , tephrochronology, dendrochronology, luminescence, and soil chronology.

Progress on Tasks:

Work in progress has concentrated on stratigraphic relationships between lake deposits and aeolian and fluvial sediments and landforms to provide the basis for regional models of the response of surficial processes and landforms to climatic change. This has involved documentation of episodes of alluvial fan and river terrace development and erosion; and correlation of these to climatically driven lake-level fluctuations as revealed by shoreline features such as strandlines and beach ridges. Work has concentrated on:

1. General reconnaissance of alluvial deposits in various locations in the White Pine, Egan, Butte, Diamond and Desatoya Ranges, Nevada;
2. Location and characterization of interface localities between lacustrine and alluvial deposits;
3. Collection of close-interval samples for ostracode characterization from "younger Dryas" lacustrine deposits in North-central Nevada;
4. Collection of charcoal samples to allow dating of process-specific alluvial sediments and features in the Illipah Wash drainage basin;
5. Collection of cores and paleomagnetic samples from Late Pleistocene Lahontan Basin lacustrine deposits

In the Mojave Desert, we are documenting periods of enhanced aeolian activity through studies of sand ramps and dunes. The basic framework is being provided via stratigraphic and sedimentological studies of regional transects of eolian accumulations from Death Valley to the San Bernardino Mountains and from the Tehachapi Pass to the Colorado River. Chronological control is provided by luminescence dating of eolian sand units. We are also making detailed studies of eolian deposits in areas impacted by fluvial flooding (e.g. the Cronese Basin). Preliminary results indicate major periods of eolian activity prior to 20,000 years and between 15,000 and 8,000 years ago, which correspond to times of low and fluctuating lake levels and regional desiccation.

Geomorphology (Continued)

An intervening period of surface stability and soil formation on the sand ramps is associated with wetter climates and higher lake levels in the region.

Our data from the Mojave Desert also show that was a major change in the eolian environment in the early-mid Holocene. Prior to this time sediment supply from fluctuating lakes was apparently sufficient to promote the accumulation of large climbing and falling dunes, even in relatively mesic climates compared to today. After the desiccation of the region in the latest Pleistocene and early Holocene, no further sediment was available from lacustrine sources and the sand ramps studied here ceased to accumulate. Holocene aeolian activity was apparently restricted to the major dune fields and to areas of active sediment supply (e.g. adjacent to the Mojave River). Periods of stabilization of dunes during the Holocene (e.g. around 4,000 years ago) are associated with wetter and cooler climates throughout the Mojave and adjacent regions.

Problems Encountered:

None to report.

TRANSPORTATION

Dr. Richard French, Principal Investigator

Project Goal:

The goal of this project is to compare the results from three models (FESWMS-2DH, DAMBRK, and FLO-2D) that have been suggested as appropriate for evaluating flood flows on alluvial fans with the results obtained from the traditional one-dimensional, stochastic model used in previous research performed by DRI for the Yucca Mountain Project. In a previous research project, three alluvial fans with rail transportation alignments crossing them were identified; hydrologic data were collected; flood hazard/drainage analyses were performed using the one-dimensional stochastic model; and the results of the flood hazard/drainage analyses compared with the documented historic performance of the drainage system. Therefore, the basis for this comparison of model results will be these three alluvial fans.

Progress on Tasks:

Task 1 During the past quarter, field activities on the four alluvial fans (UPRR1 and UPRR2, Stateline, Nevada; UPRR3, Apex, Nevada; and Scarp Canyon, Nevada Test Site, Nye County, Nevada) that will be used in this study were undertaken. The geologic and hydrologic settings of these alluvial fans have been established and appropriate sections for the final report have been written.

Task 2 The flooding on the four alluvial fans is currently being modeled with DAMBRK. Contacts have been established for assistance with this model should the need arise.

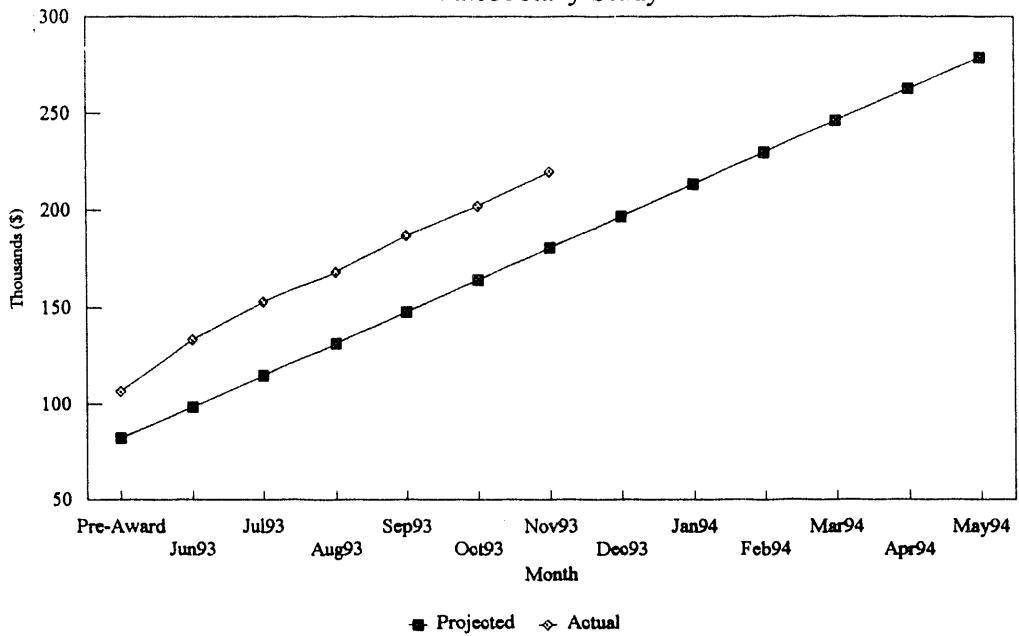
Task 3 Copies of the topographic maps with the study area alluvial fan boundaries defined have been sent to Dr. Jim O'Brien (FLO Engineering, Breckenridge, Colorado) to be digitized and establish a grid system for the FLO-2D model.

Task 4 A dialogue with Alberta Environment personnel has been established regarding a previous peer reviewed publication ("Preferred Directions of Flow on Alluvial Fans," Journal of Hydraulic Engineering, Vol. 118, No. 7, pp. 1002-1013). Alberta Environment recently provided data for a hundred alluvial fans in Alberta which will be examined during the next quarter.

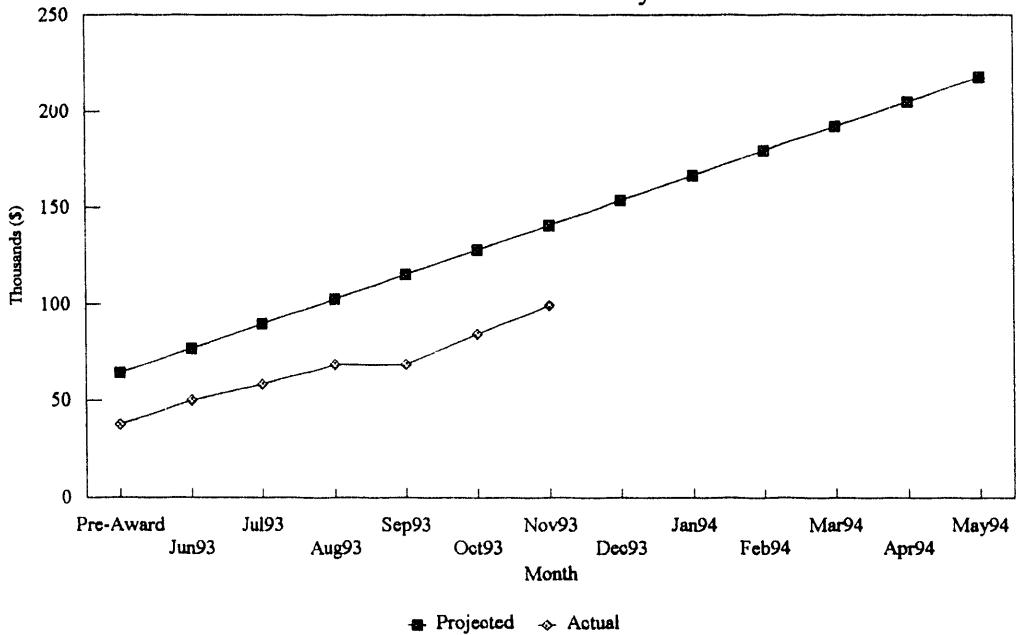
Problems Encountered:

Sufficient funding is not currently available to meet the milestones and deliverables contained in the proposal.

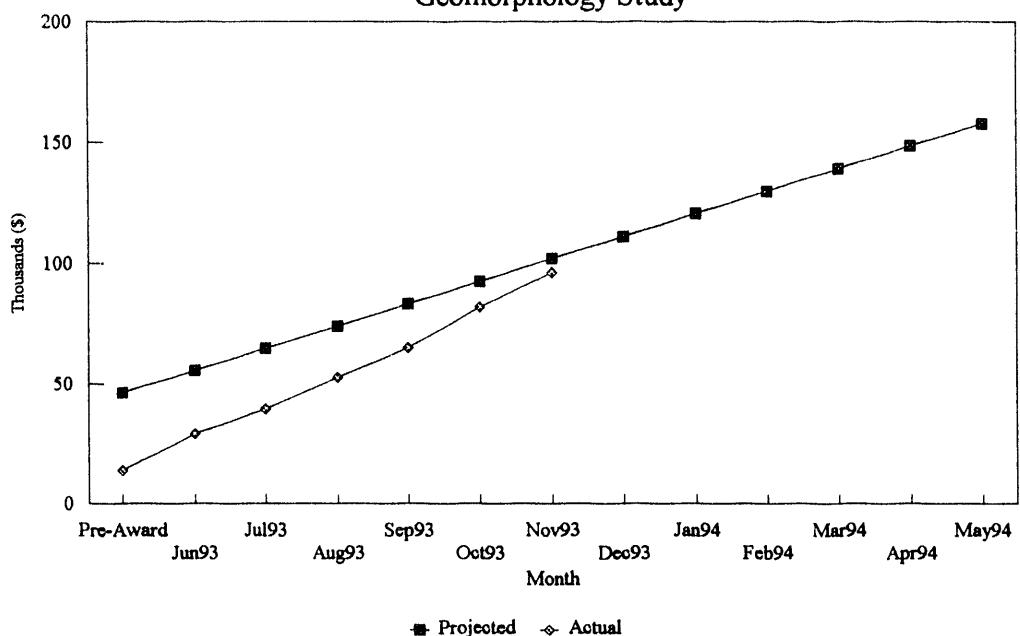
FY 1993 Budget Summary
Paleobotany Study



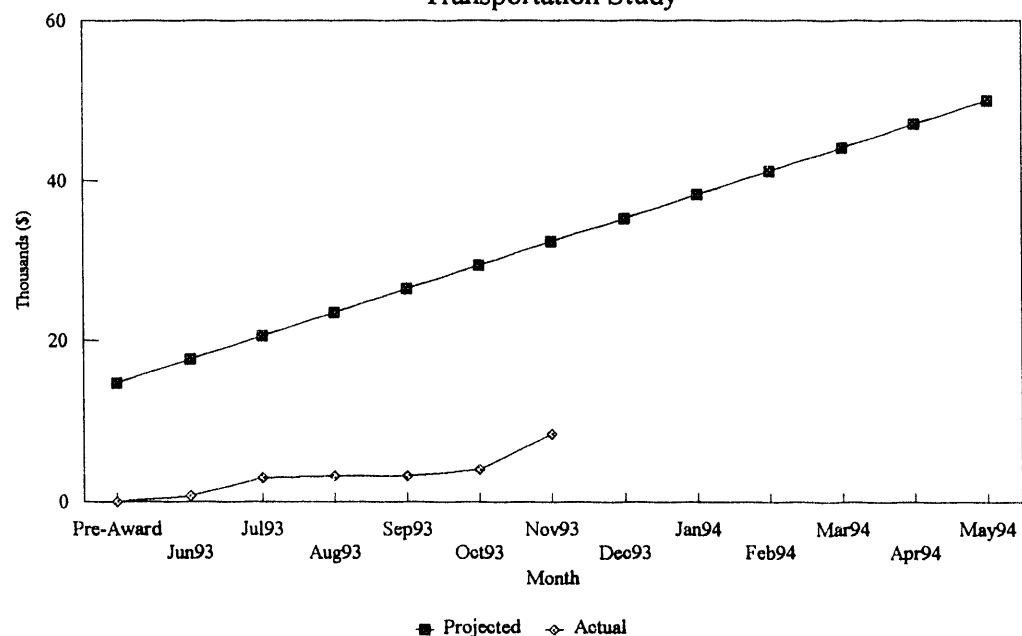
FY 1993 Budget Summary
Paleofauna Study



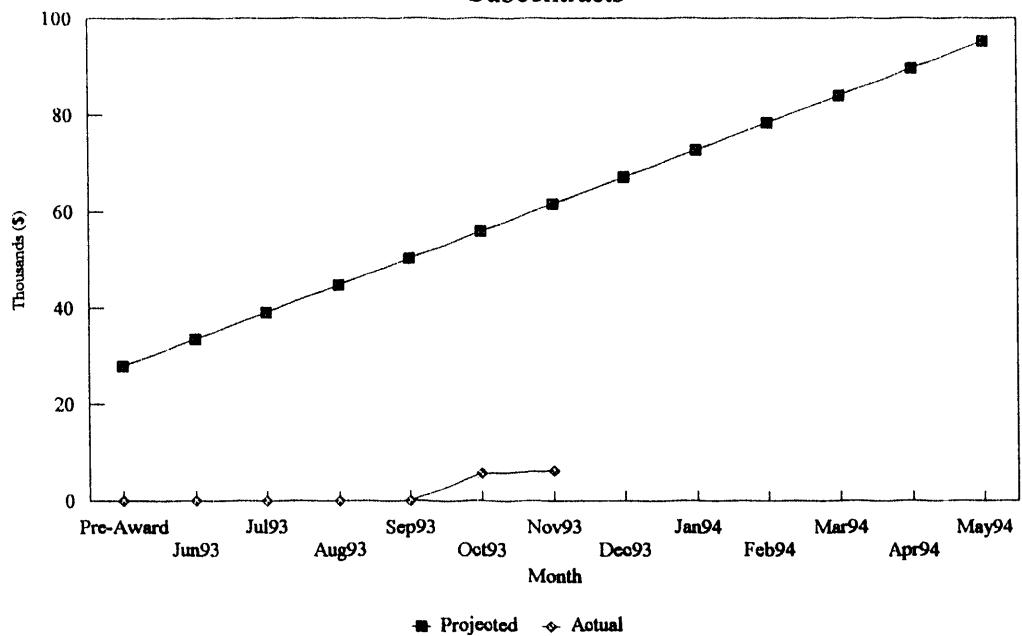
FY 1993 Budget Summary
Geomorphology Study



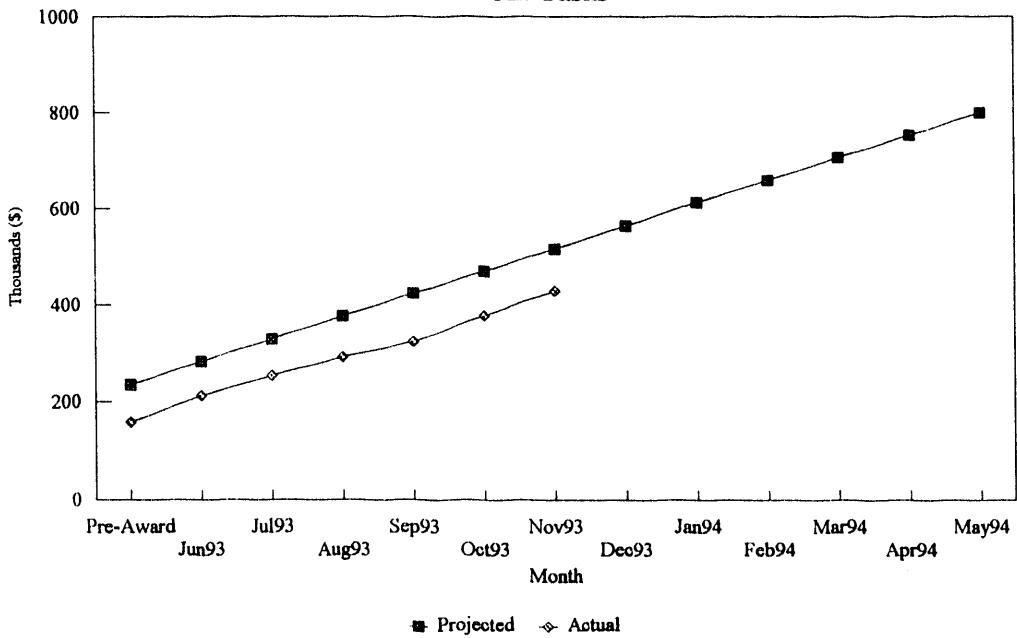
FY 1993 Budget Summary
Transportation Study



FY 1993 Budget Summary
Subcontracts



FY 1993 Budget Summary
All Tasks



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