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THE AEROSPACE CORPORATION

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10 April 1979

Mr. Paul Lombardi
Chief, Vehicle Systems Section
Transportation Energy Conservation Division
U. S. Department of Energy
20 Massachusetts Avenue
Washington, D. C. 20545

Dear Mr. Lombardi:

Enclosed are seven copies of the eighth monthly progress report on our contract for "Technical Analysis Support for Transportation Energy Conservation Division of DOE." This report covers the period 1 March through 31 March 1979.

If you have any questions about this report, please do not hesitate to call me, Wolfgang Roessler (213) 648-5550, or Toru Iura (301) 428-2754, at any time.

Very truly yours,

Merrill Hinton

Merrill G. Hinton
Principal Director
Mobile Systems Directorate

Telephone: (213) 648-7110

MGH:pm

Enclosures, as noted

cc - William Lambert

bc -
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R. T. Hall
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EIGHTH PROGRESS REPORT

(for March 1979)

TECHNICAL ANALYSIS SUPPORT FOR TRANSPORTATION ENERGY CONSERVATION DIVISION OF DOE

MASTER

10 April 1979

Contract No. EM-78-C-03-2184

Prepared by

Mobile Systems Directorate
Eastern Technical Division
THE AEROSPACE CORPORATION
El Segundo, California

for the

Transportation Energy Conservation Division
U. S. DEPARTMENT OF ENERGY
Washington, D. C.

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EIGHTH PROGRESS REPORT

(for March 1979)

TECHNICAL ANALYSIS SUPPORT FOR TRANSPORTATION ENERGY CONSERVATION DIVISION OF DOE

1. INTRODUCTION

The Aerospace Corporation is providing technical analysis support services to the DOE Transportation Energy Conservation (TEC) Division under Contract No. EM-78-C-03-2184. These services were initiated on June 15, 1978, under an advance agreement; the contract was signed by DOE on August 17, 1978.

The nature of the services being provided is similar to that of a previous 30-month support services contract between Aerospace and DOE/TEC (Contract No. EY-76-C-03-1101, Project Agreement No. 3); in several instances the work to be done is a direct continuation of activities initiated under the previous contract.

The period of performance under this contract commenced on June 15, 1978 and expires on June 14, 1979. DOE has the right to authorize an optional additional year of effort which could extend the contract period to June 14, 1980. The contract is being incrementally funded; $1,060,000 is the amount presently obligated. The obligation limit for the first year of effort (through June 14, 1979) is $1,488,785.

The following sections (1) present the status of achieved progress through the period ending 31 March 1979, and (2) summarize the expenditure status. Historical information concerning task assignments and reporting activities is provided in Appendices A and B.

2. ORGANIZATION OF SUPPORT EFFORT

Five Branches within DOE/TEC have presently committed funding support to the contract; they include:

	Presently Obligated	In Process	Total to Date
1. Heat Engine Systems (G. Thur)	$ 400,000	$ 500,000	$ 900,000
2. Alternative Fuels Utilization (E. Ecklund)	175,000	75,000	250,000
3. Nonhighway Transport Systems (R. Alpaugh)	120,000	100,000	220,000
4. New Concepts Evaluation (M. Starr)	60,000	-	60,000
5. Electric and Hybrid Vehicle R & D (R. Kirk and K. Barber)	305,000	265,000	570,000
	$1,060,000	$ 940,000	$2,000,000

A sixth Branch, Technology Assessment and Implementation, may elect to commit funds at a later date. In addition, it is contemplated that it will be necessary to support certain TEC-wide program documentation efforts.

To provide for control and tracking of expenditures and efforts for each of the above Branches and Division activities, a series of Job Orders (JO's) has been initially selected and assigned to current and prospective support needs. They are summarized in Table 1. An historical description of the work efforts assigned during this contract for the above activities is presented in Appendix A.

3. PROGRESS FOR THIS REPORTING PERIOD

Brief summaries of status and progress are given below for those support activities in progress through March 31, 1979.

3.1 Heat Engine Systems

3.1.1 Automotive Technology Assessment Study (JO 7751)

Objective: To assist TEC in preparing the annual report to Congress required by Automotive Propulsion Research and Development Act of 1978 (Title III of Public Law 95-238). Requires technology assessments, planning, and report writing and coordination.

Status: Comments and suggestions pertaining to the format and contents of the Annual Report were developed and presented to the DOE/NASA Automotive Heat Engine Program Management Review Meeting on June 17, 1978. General agreement was reached on a plan whereby Aerospace and NASA/Lewis would prepare initial

inputs. A rough draft strawman document was prepared by Aerospace and transmitted to Mr. Lombardi on 1 November 1978 for his review and approval. DOE's review comments were discussed in a number of meetings and telecommunications with Mr. Lombardi, Mr. Thur, and Mr. Brogan. The final version of the report was transmitted to Mr. Lombardi on 27 February 1979.

3.1.2 Technical Responses to Inquiries (JO 7752)

Objective: To provide quick-response support by (1) reviewing inquiries submitted to the Office of Highway Systems, and (2) preparing technical inputs for letter responses to inventors, Congressional offices, and concerned citizens.

Status: During the month of March, technical responses were prepared for 30 inquiries which were received by the Office of Highway Systems.

3.1.3 Highway Systems Analysis Support (JO 7753)

3.1.3.1 Fuel Consumption and Emission Characteristics of Stratified Charge Engines

Objective: To assess the technological status of stratified charge engines and provide a basis for predicting the fuel economy potential of these engine/vehicle systems as affected by increasingly stringent NO_x and HC emission regulations. Of particular interest is the projected fuel economy that might be achieved with these engines at the statutory NO_x level of 0.4 gram/mile.

Status: This study, which was initiated during the previous contract, involves the analysis of the emissions and fuel economy characteristics of Ford's PROCO and Texaco's TCCS open-chamber stratified charge engines, and the effects of NO_x control level and inertia weight variations on fuel economy of vehicles equipped with these engines. A draft report was completed which is currently undergoing in-house review, preparatory to transmittal of the report to DOE.

3.1.3.2 Summary of Diesel-related Work in Areas of Technology Development and Health Effects

Objective: To summarize all diesel-related work in the areas of technology development and health effects currently in progress by industry and governmental agencies. To identify specific areas which are currently not adequately

covered by ongoing or projected programs, and which therefore are considered to be candidates for DOE support.

Status: At the request of Mr. Themak, EPA's draft, "Regulatory Analysis Report on Light-duty Diesel Particulate Regulations," was reviewed, and an analysis was performed of diesel emission control system performance, with particular emphasis on the tradeoffs between HC, NO_x, particulates, and fuel economy. A brief summary report was submitted to Mr. Themak on 2 March 1979.

3.1.3.3 Heat Engine Thermal Efficiency

Objective: To determine theoretical and actual air cycle and fuel-air cycle efficiencies for automotive heat engines.

Status: Theoretical and brake thermal efficiencies were computed for Otto, diesel, Brayton, and Stirling cycle engines as a function of many parameters, including compression ratio, air-fuel ratio, turbine inlet temperature, Stirling heater head temperature, and regenerator effectiveness. The computed efficiencies at the best operating point of the engine and over the Federal Driving Cycle were compared with actual values determined from measured vehicle fuel economy data. Results of this analysis were transmitted to Mr. Brogan on 16 March 1979. A final report is in preparation.

3.1.3.4 Engine-Fuel-Refinery System Tradeoff

Objective: To determine transportation mileage and crude oil savings related to the production and utilization of alternate fuels.

Status: Crude oil utilization efficiency expressed in terms of vehicle miles driven per barrel of crude oil, was determined for a number of scenarios involving the increased use of diesel engines, as well as the introduction of gas turbines, Stirling engines, and open-chamber stratified charge engines using wide-cut fuels in place of gasoline or diesel fuel. Initial study results were transmitted to Mr.Brogan on 23 March 1979.

3.1.3.5 Evaluation of Unsolicited Proposals and Reports

Objective: To perform technical evaluations of unsolicited proposals and reports submitted to the Office of Highway Systems.

Status: At the request of Mr. Lombardi, three unsolicited proposals were reviewed during this report period. It was recommended that DOE not support the development of the proposed concepts.

One proposal, entitled "Pentagonal Electromagnetic Engine," involves the development of an electric motor composed of five solenoids arranged in a circle and operating a connecting rod/crankshaft mechanism identical in concept to a radial piston engine. The use of solenoids and a complicated mechanical linkage to provide a rotary motor was judged to be much less efficient than the conventional DC electrical motor.

The second proposal, entitled "Gearbine Rotary Engine," is concerned with a Brayton cycle type engine consisting of a multistage gear pump for air compression, with the same gear units being used for expansion of the combustion gas. Because of its inferior efficiency and large size relative to conventional gas turbines and Otto cycle engines, the proposed engine has no fuel conservation potential.

The third proposal involves the development of a dual-cycle heat engine, consisting of a Rankine cycle unit and a refrigeration unit. The refrigerant is supposed to absorb the heat of vaporization of the Rankine cycle, returning the heat plus the compression heat to the Rankine cycle. The system as proposed violates the second law of thermodynamics, and has no fuel conservation potential.

At the request of Mr. Alpaugh, a review is being made of an unsolicited proposal and background material on wind-powered cargo ships. The proposer forecasts fuel savings up to 85 percent relative to conventional cargo ships at the expense of somewhat longer trip times.

3.1.3.6 Development of Vehicle Systems Program Activity Displays

Objective: To define and develop visual techniques to display and monitor the content and activity level of the Vehicle Systems Program.

Status: Data were collected on ten programs for display on the DOE status chart. The ten programs are Advanced Transmissions, Chrysler Gas Turbine Vehicles, Stirling Engine Vehicles, Gas Turbine Transit Bus Demonstration,

Controlled Speed Accessory Drive Demonstration, Truck Bottoming Cycle Program, Turbocompound Diesel Truck, Ceramic Gas Turbine Truck, Hydrogen Engine Vehicle, and Student Competitions on Relevant Engineering. Preliminary conceptual activity summary sheets were prepared for each project and provided to P. Lombardi. Based on his review and the comments of A. Chesnes, the next level of activity was focused on a geographic orientation status board for top level tracking of project status. This status board is scheduled for completion by 20 April.

3.1.3.7 Research Needs for Automotive Engines

Objective: To identify basic and applied research needs in the areas of intermittent and continuous combustion automotive heat engines, and to outline specific research programs aimed at the achievement of significant improvements in automobile fuel economy.

Status: At the request of Mr. Brogan, a list of research needs was prepared for various categories of advanced automotive power systems. The Conference on Basic Research Directions for Advanced Automotive Technology, held on February 13 and 14, 1979 in Boston, Massachusetts, was attended, and quick-response support was provided at that meeting to both the Engine and Fuels/Powertrain Systems Panels, assisting these panels in the preparation of summary reports to the Secretary of Transportation.

3.2 Alternative Fuels Utilization

3.2.1 Distillery Impact Study (JO 7756)

Objective: To determine the role the distilling industry can fill in producing alcohol for fuel use; to determine the technological, economic, institutional, and environmental characteristics of the fermentation industries producing industrial ethanol and distilled spirits.

Status: The work plan for this study was defined during the previous contract and submitted to TEC on March 30, 1978. During the July 30 to August 4 time period, visits were made and discussions held to acquire data needed for further analysis. Companies visited included: Kentucky Distillers Association, Frankfort, Kentucky; Old Grand Dad, Frankfort, Kentucky; Midwest

Solvents, Atchison, Kansas; Milbrew, Milwaukee, Wisconsin; and Georgia-Pacific Corporation, Bellingham, Washington.

A rough draft of the final report was completed in mid-December and forwarded to E. E. Ecklund for review. His review comments were received in late January. The final report (ATR-79(7756)-1) was published and forwarded to Mr. Ecklund on 30 March.

3.2.2 Fuel Economy Improvement Potential Study (JO 7758)

Objective: To determine the combustion efficiency potential of spark ignition engines and the potential impact of fuel modifications. Phase I involves the analysis of combustion losses of late-model engines; Phase II involves theoretical analyses of combustion inefficiencies as affected by variations in fuel heat release rate.

Status: The study of engine efficiency losses, as represented by HC and CO exhaust emissions, was completed during this report period. Vehicle simulation (VEHSIM) computer program calculations were performed for eight 1977 and six 1978 model year spark ignition and diesel engine/vehicle configurations, considering both raw engine and catalyst emissions. Combustion efficiency results obtained from these vehicle simulations over the urban driving cycle, and from combustion efficiency maps previously calculated, were summarized in two interim reports transmitted to Dr. Fleming on 15 November 1978 and 30 March 1979.

The Phase II final report, which analyzes the effects of combustion rate on engine efficiency, was transmitted to Dr. Fleming on 9 February 1979.

3.2.3 Alternative Fuels Analysis Support (JO 7759)

3.2.3.1 Hydrogen Powered vs. Electric Automobiles

Objective: To compare the costs and benefits of the generation of hydrogen and its use as fuel in a spark ignition engine versus the direct use of electric energy in battery-operated vehicles.

Status: The study has been completed and documented in a final draft report consisting of an executive summary and separate sections on each of the four principal study tasks: (1) hydrogen production, (2) hydrogen vehicle

assessment, (3) electric vehicle assessment, and (4) technical and economic comparison of hydrogen and battery-powered vehicles. The draft report, which has been reviewed by nine outside organizations, has been transmitted to DOE for review, and approval for publication has been received from Mr. Ecklund. The report was turned over to the publications group in February for final editing and printing.

3.2.3.2 Project Plan for Reliability Fleet Testing of Alcohol/Gasoline Blends

Objective: To prepare a Project Plan which defines all aspects of the requirements for adequately demonstrating the in-use reliability of alcohol/gasoline blends via fleet testing.

Status: An initial version of the project plan was completed and transmitted to E. E. Ecklund on July 31, 1978. Review comments were received and the document was revised accordingly. The second version was submitted in mid-September and further revised in mid-October. A meeting was held on December 6, 1978 to review the plans made to date. Based on that review, the CRC meeting in Detroit on December 12 was attended to get their inputs to and comments on the plan. Efforts were initiated during the third week in December to secure the services of SWRI to assist in planning the fleet testing activities. SWRI was issued a purchase order in mid-January and has commenced the required task.

The CRC Alternate Automotive Fuels Group meeting was attended in Atlanta, Georgia on February 14. The principal discussion focused on subgroup reports concerning analytical procedures, fuel selection, and vehicle selection criteria to be recommended for alcohol/gasoline blend use.

The following day, Mr. E. Eugene Ecklund convened a meeting of CRC members and other interested parties to review the Fleet Selection Criteria Document prepared by SWRI and Aerospace. This document will be revised according to the comments received.

A March 30, 1979 revision of the Project Plan was completed which incorporated the results of all the foregoing meetings and discussions. A presentation was prepared to outline the program at the Highway Vehicle Systems Contractors' Coordination Meeting in Dearborn, Michigan, April 24-16, 1979.

3.2.4 Nonhighway Transport Systems

3.2.4.1 Commercial Aviation Nonhardware Energy Conservation Strategies (JO 7761)

Objective: To examine commercial aviation operational policies and fuel conservation strategies and identify those that are the most beneficial and deserving of DOE support.

Status: During the month of March, letters were received from Continental and Alaska Airlines delineating the incremental costs which they would incur and charge, as subcontractors to Aerospace, for their participation in a program intended to demonstrate reduced fuel consumption of commercial airliners through improved airframe maintenance. Subsequently, work statements were drafted describing the airlines' tasks in the planned program. The work statement and airline cost estimates are intended to be used as a basis for negotiating separate subcontracts with Continental and Alaska.

At the request of Mr. Alpaugh, a presentation was given to the FAA on 16 March 1979 on the recently completed Aerospace study of Commercial Aviation Operational Energy Conservation Strategies. In preparation for this presentation, an analysis of the relative contribution of load factor changes and the contribution of the implementation of conservation strategies to year-to-year variations in revenue ton miles per gallon (RTMPG) performance was formulated. Results of the analysis show that only about 1 percent of a 16 percent improvement in RTMPG between 1972 and 1975 can be attributed to conservation efforts, while the remaining 15 percent improvement is related to load factor changes. A recent FAA report attributes the entire 16 percent improvement in RTMPG to implementation of conservation strategies.

3.2.5 New Concepts Evaluation (JO 7764)

Objective: To provide analyses and technical support to facilitate DOE's evaluation of specific proposals received by DOE.

Status: No proposal evaluations were performed during this reporting period.

3.2.6 Electric and Hybrid Vehicle R & D

3.2.6.1 EHV Program Coordination Support (JO 7765)

Objective: To provide close support to the EHV R & D Coordinating Committee in the areas of analysis, assessment, and planning.

Status: The following activities were in progress during the reporting period, or are of a continuing nature.

1. General Support to the EHV Coordinating Committee

Objective: To participate in bimonthly R & D work sessions and provide planning support.

Status: Aerospace participated in the Quarterly Project Review of the EHV activities at the four national laboratories.

2. Preparation of Level II R & D Plan for EHV Program

Objective: To expand the current Level I Program Plan to a more definitive and descriptive version (Level II).

Status: The Vehicle Systems timeline chart has been revised to reflect the new program organization. Inputs to the project descriptions are still being received from DOE Headquarters personnel. Work on the plan itself has had to slip due to higher priority tasks. A May delivery of the plan to the General Accounting Office is now scheduled.

3. Goals Study

Objective: The major thrust of this activity is the formulation of goals for the EHV R & D Program based on the Level I and Level II Plans.

Status: No new activity in this area.

4. Miscellaneous Support Activities

Objective: To perform various quick-response support tasks as requested by the R & D Coordinating Committee.

Status: At the request of DOE, Aerospace is in the process of contracting with firms to assist in technical information dissemination for the R & D Program. It is anticipated that these firms will be on subcontract by mid-April.

3.2.6.2 Electric and Hybrid Vehicle Analysis Support (JO 7766)

Objective: This task area encompasses assignments of analysis and assessment of electric and hybrid vehicle systems and components.

Status: The following activities were in progress during the reporting period.

1. Proposal/Report/Correspondence Analysis

Objective: This effort includes detailed analyses of proposals and reports, reviews of the DOE EHV Annual and Quarterly Reports, and reviews of miscellaneous DOE reports, as well as preparation of technical responses to inquiries.

Status: No activity during this period.

2. Development of Technique for Including Electric Vehicles in Corporate Average Fuel Economy (CAFE) Standards

Objective: To develop an approach and technique whereby the energy-use-equivalence of electric vehicles could be incorporated into the CAFE standards.

Status: This area has been the primary focus during the reporting period. The CAFE briefing has been presented to Garrett/AiResearch (March 15), Jet Propulsion Laboratory (March 16), The Aerospace Corporation/Mobile Systems Group (March 19), and General Motors (March 27). These briefings have been very beneficial. Numerous excellent comments and offers of assistance were received. The meeting with General Motors was particularly valuable. Based on these comments, several revisions and expansions of the briefing have been made.

A meeting with Chrysler personnel has been scheduled for April 25. No fixed date has been set as yet for Ford. With Senator McClure's introduction of Senate Bill 624, interest in the subject has greatly increased among the auto manufacturers. It is hoped that these industry briefings can be completed in April.

3.2.6.3 Electric and Hybrid Vehicle Performance Standards Support (JO 7767)

Objective: This task involves analyses of the current state of the art of the performance capabilities of EHV technology to provide a basis for recommending

future-year EHV performance standards. It will provide DOE with a defensible basis for setting future standards. The first cycle is to be completed by December 1979.

Status: During this reporting period, discussions continued with individuals representing interested organizations who have comments on the existing demonstration performance standards. During this month, 15 companies or organizations were contacted. Interview material has been written for the rough draft of the report which will go to DOE. A list of potential recommended performance standards changes has been drafted.

4. CURRENT STATUS OF ALL ACTIVITIES

Appendix A and Section 3 above describe the specific assignments made to date and their general schedule requirements. Figure 1 depicts this information in graphical format. As can be noted, much of the effort is of the continuing, quick-response, or intermittent nature.

Appendix B is a summary table which delineates the principal reporting activities of The Aerospace Corporation on all task assignments from the inception of the contract to date.

5. PROBLEM AREAS

No major problems of a technical nature were encountered during this reporting period.

6. PLANNED ACTIVITIES FOR APRIL 1979

The month of April will be devoted to continuing those task activities under way, and in initiating any newly-defined tasks that may be assigned during that period.

7. EXPENDITURE STATUS

The currently obligated funding level is $1,060,000, with an additional $940,000 currently being processed for a total funding level to date of $2,000,000. The apportionment of these funds by Job Order (JO) is summarized in Table 2, together with an accounting of cumulative expenditures on a monthly basis.

The cumulative actual total expenditure through this reporting period is $758,000.

Table 1. JO's Assigned

Heat Engine Systems

7751	Automotive Technology Assessment Study
7752	Technical Responses to Inquiries
7753	Highway Systems Analysis Support
7754	Evaluation of Specific Engines/Systems
7755	Special Heat Engine System Studies

Alternative Fuels

7756	Distillery Impact Study
7757	Immediate Action Studies Support
7758	Fuel Economy Improvement Potential Study
7759	Alternative Fuels Analysis Support
7760	Special Alternative Fuels Studies

Nonhighway Systems

7761	Commercial Aviation Fuel Economy Study
7762	General Aviation Fuel Economy Study
7763	Nonhighway Systems Analysis Support

New Concepts Evaluation

7764	Proposal Evaluations

Electric and Hybrid Vehicles

7765	EHV Program Coordination Support
7766	Electric and Hybrid Vehicle Analysis Support
7767	Electric and Hybrid Vehicle Performance Standards Support

Technology Assessment and Implementation

7768	Assessment and Implementation Overview

Technical Program Documentation

7769	Program Planning and Analysis
7770	Management Review and Control Documentation

Table 2. Cumulative Expenditure History with Job Order Breakdown

Job Order Number	Task Description	Presently Allocated Funds(1)	Actual Expenditure Through 7/31/78	Actual Expenditure Through 8/31/78	Actual Expenditure Through 9/30/78	Actual Expenditure Through 10/31/78	Actual Expenditure Through 11/30/78	Actual Expenditure Through 12/31/78	Actual Expenditure Through 1/31/79	Actual Expenditure Through 2/28/79	Actual Expenditure Through 3/31/79
	HEAT ENGINE SYSTEMS		(34,900)	(98,600)	(143,900)	(173,500)	(205,000)	(243,700)	(287,800)	(324,100)	(371,700)
7751	Automotive Technology Assessment		2,100	3,000	17,900	29,400	33,900	45,100	50,200	56,600	57,400
7752	Technical Responses to Inquiries		12,700	19,500	24,300	28,500	34,600	41,200	45,700	53,100	63,000
7753	Highway Systems Analysis Support	$900K	20,100	76,100	97,400	106,000	122,500	143,400	177,900	199,800	236,700
7754	Evaluation of Specific Engines/Systems		0	0	4,300	9,600	14,000	14,000	14,000	14,600	14,600
7755	Special Heat Engine System Studies		0	0	0	0	0	0	0	0	0
	ALTERNATIVE FUELS		(19,400)	(47,200)	(62,600)	(71,200)	(79,900)	(105,600)	(126,000)	(145,500)	(175,900)
7756	Distillery Impact Study		5,200	8,200	9,200	9,400	11,700	15,200	15,200	16,500	19,300
7757	Immediate Action Studies Support		0	9,600	15,100	17,900	18,000	18,100	18,100	18,300	18,800
7758	Fuel Economy Improvement Potential	$250K	1,700	6,000	10,700	10,700	12,300	17,900	23,600	29,900	36,800
7759	Alternative Fuels Analysis Support		12,500	23,400	27,600	33,200	37,500	54,000	68,600	80,300	100,500
7760	Special Alternative Fuels Studies		0	0	0	0	400	400	500	500	50
	NONHIGHWAY SYSTEMS		(10,500)	(13,100)	(17,300	(18,300)	(21,000)	(29,800)	(37,900)	(45,900)	(55,800)
7761	Commercial Aviation Fuel Economy		10,500	13,100	16,200	16,900	19,600	28,400	36,500	44,500	54,400
7762	General Aviation Fuel Economy	$220K	0	0	0	0	0	0	0	0	0
7763	Nonhighway Systems Analysis Support		0	0	1,100	1,400	1,400	1,400	1,400	1,400	1,400
	NEW CONCEPTS EVALUATION		(2,100)	(2,900)	(4,700)	(5,100)	(8,800)	(13,100)	(13,100)	(14,200)	(15,100)
7764	Proposal Evaluations	$60K	2,100	2,900	4,700	5,100	8,800	13,100	13,100	14,200	15,100
	ELECTRIC & HYBRID VEHICLE R & D		(10,300)	(24,500)	(46,200	(57,900)	(72,500)	(87,300)	(100,300)	(118,700)	(139,400)
7765	EHV Program Coordination Support		10,300	24,500	46,200	57,900	72,300	83,300	92,600	101,500	113,300
7766	Electric Vehicle Analysis Support	$570K	0	0	0	0	200	3,500	5,900	11,000	14,000
7767	Hybrid Vehicle Analysis Support		0	0	0	0	0	500	1,800	6,200	12,100
	TECHNOLOGY ASSESSMENT		(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
7768	Assessment and Implementation Overview	$0	0	0	0	0	0	0	0	0	0
	TECHNICAL PROGRAM DOCUMENTATION		(0)	(0)	(0)	(0)	(100)	(100)	(100)	(100)	(100)
7769	Program Planning and Analysis	*	0	0	0	0	100	100	100	100	100
7770	Management Review and Control Document		0	0	0	0	0	0	0	0	0
	TOTALS	$2,000	77,200	186,300	274,700	326,000	337,300	479,600	565,200	648,500	758,000

*Assignments to be charged pro-rata to other funding categories.

(1) Includes $940,000 being processed as of 4/6/79.

Table 3. Monthly Expenditure History with Job Order Breakdown

Job Order Number	Task Description	July 1978 Expenditure	August 1978 Expenditure	September 1978 Expenditure	October 1978 Expenditure	November 1978 Expenditure	December 1978 Expenditure	January 1979 Expenditure	February 1979 Expenditure	March 19[illegible] Expenditure
	HEAT ENGINE SYSTEMS	(34,900)	(63,700)	(45,300)	(29,600)	(31,500)	(38,700)	(44,100)	(36,300)	(47,600)
7751	Automotive Technology Assessment	2,100	900	14,900	11,500	4,500	11,200	5,100	6,400	800
7752	Technical Responses to Inquiries	12,700	6,800	4,800	4,200	6,100	6,600	4,500	7,400	9,900
7753	Highway Systems Analysis Support	20,100	56,000	21,300	8,600	16,500	20,900	34,500	21,900	36,900
7754	Evaluation of Specific Engines/Systems	0	0	4,300	5,300	4,400	0	0	600	0
7755	Special Heat Engine System Studies	0	0	0	0	0	0	0	0	0
	ALTERNATIVE FUELS	(19,400)	(27,800)	(15,400)	(8,600)	(8,700)	(25,700)	(20,400)	(19,500)	(30,400)
7756	Distillery Impact Study	5,200	3,000	1,000	200	2,300	3,500	0	1,300	2,800
7757	Immediate Action Studies Support	0	9,600	5,500	2,800	100	100	0	200	500
7758	Fuel Economy Improvement Potential	1,700	4,300	4,700	0	1,600	5,600	5,700	6,300	6,900
7759	Alternative Fuels Analysis Support	12,500	10,900	4,200	5,600	4,300	16,500	14,600	11,700	20,200
7760	Special Alternative Fuels Studies	0	0	0	0	400	0	100	0	0
	NONHIGHWAY SYSTEMS	(10,500)	(2,600)	(4,200)	(1,000)	(2,700)	(8,800)	(8,100)	(8,000)	(9,900)
7761	Commercial Aviation Fuel Economy	10,500	2,600	3,100	700	2,700	8,800	8,100	8,000	9,900
7762	General Aviation Fuel Economy	0	0	0	0	0	0	0	0	0
7763	Nonhighway Systems Analysis Support	0	0	1,100	300	0	0	0	0	0
	NEW CONCEPTS EVALUATION	(2,100)	(800)	(1,800)	(400)	(3,700)	(4,300)	(0)	(1,100)	)
7764	Proposal Evaluations	2,100	800	1,800	400	3,700	4,300	(0)	1,100	900
	ELECTRIC AND HYBRID VEHICLE R & D	(10,300)	(14,200)	(21,700)	(11,700)	(14,600)	(14,800)	(13,000)	(18,400)	(20,700)
7765	EHV Program Coordination Support	10,300	14,200	21,700	11,700	14,400	11,000	9,300	8,900	11,800
7766	Electric Vehicle Analysis Support	0	0	0	0	200	3,300	2,400	5,100	3,000
7767	Hybrid Vehicle Analysis Support	0	0	0	0	0	500	1,300	4,400	5,900
	TECHNOLOGY ASSESSMENT	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
7768	Assessment and Implementation Overview	0	0	0	0	0	0	0	0	0
	TECHNICAL PROGRAM DOCUMENTATION	(0)	(0)	(0)	(0)	(100)	(0)	(0)	(0)	(0)
7769	Program Planning and Analysis	0	0	0	0	100	0	0	0	0
7770	Management Review and Control Document	0	0	0	0	0	0	0	0	0
	TOTALS	77,200	109,100	88,400	51,300	61,300	92,300	85,600	83,300	109,500

Figure 1. Program Schedule

JO No.	Activity Description	CY 1978 J	J	A	S	O	N	D	CY 1979 J	F	M	A	M	J
	HEAT ENGINE SYSTEMS													
7751	Automotive Technology Assessment													
	a. Format development													
	b. Assessment activities													
	c. Report to Congress													
7752	Technical Responses to Inquiries													
7753	Highway Systems Analysis Support													
	a. First-year fuel consumption study													
	b. Diesel and Stratified Charge Engines													
	c. Diesel Technology & Health Effects													
	d. DOT 1979 Annual Report Comments													
	e. Vehicle System Prospectus													
	f. Evaluation of Proposals													
	g. Vehicle Demonstration Program Plan													
7754	Evaluation of Specific Engines/Systems													
	a. Stirling Engine Evaluation													
7755	Special Heat Engine System Studies	NO ASSIGNMENTS TO DATE												
	ALTERNATIVE FUELS													
7756	Distillery Impact Study													
7757	Immediate Action Studies Support													
7758	Fuel Economy Improvement Study													
7759	Alternative Fuels Analysis Support													
	a. H_2 versus Electric Vehicles													
	b. Alcohol/Gasoline Fleet Test Plan													
7760	Special Alternative Fuels Studies	NO ASSIGNMENTS TO DATE												

Figure 1. Program Schedule (continued)

JO No.	Activity Description	C Y 1978							C Y 1979					
		J	J	A	S	O	N	D	J	F	M	A	M	J
	NONHIGHWAY TRANSPORT SYSTEMS													
7761	Commercial Aviation Fuel Economy Study													
7762	General Aviation Fuel Economy Study	NO ASSIGNMENTS TO DATE												
7763	Nonhighway Systems Analysis Support													
	NEW CONCEPTS EVALUATION													
7764	Evaluation of Proposals													
	ELECTRIC AND HYBRID VEHICLE R & D*													
7765	EHV Program Coordination Support													
	a. R & D Committee Support													
	b. Level II R & D Plan													
	c. Goals Study													
	d. Project Reporting System													
	e. EHV Annual Report													
	f. Technology Brochure													
	g. Miscellaneous Support													
7766	EHV Analysis Support													
	a. Planning Grant Technical Analyses													
	b. Loan Guaranty Technical Analyses													
	c. Proposal/Report/Correspondence Analyses													
	d. Purdue Resource Allocation Model													
	e. CAFE Analysis													
7767	EHV Performance Standards Support													

*Revised 12/10/78

Figure 1. Program Schedule (continued)

JO No.	Activity Description	C Y 1978							C Y 1979					
		J	J	A	S	O	N	D	J	F	M	A	M	J
	TECHNOLOGY ASSESSMENT AND IMPLEMENTATION													
7768	Analysis and Assessment Support	NO FUNDING -- NO ASSIGNMENTS												
	TECHNICAL PROGRAM DOCUMENTATION													
7769	Program Planning and Analysis	NO ASSIGNMENTS TO DATE												
7770	Management Review and Control Documentation	NO ASSIGNMENTS TO DATE												

LEGEND

——— Activity of a continuous nature

- - - - - Activity of a low-level or intermittent nature

○ Formal final task report

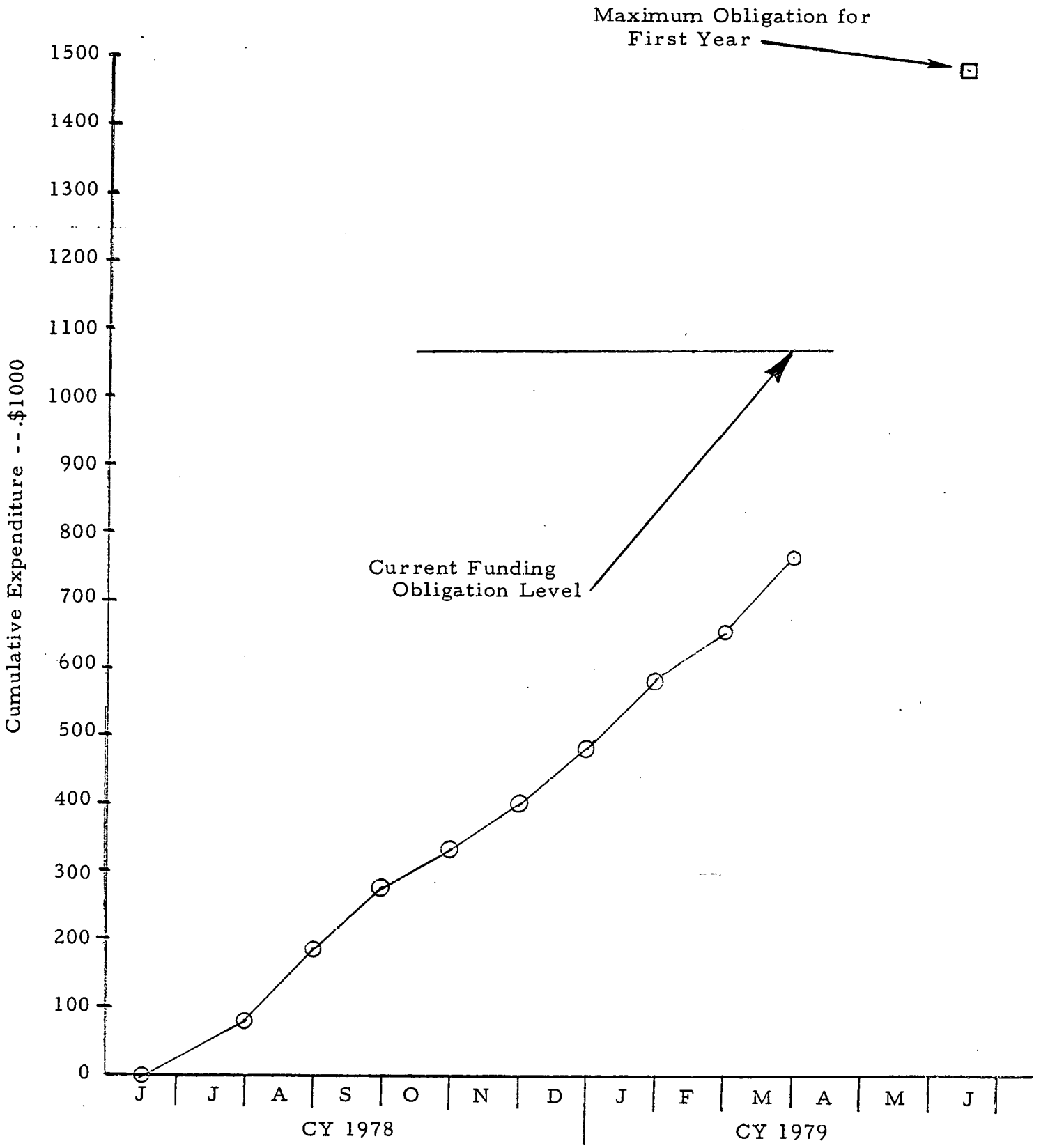
△ Rough draft of task report

⬡ Informal draft or working memorandum for DOE/TEC internal use

□ Briefing

Open symbols represent target or planned milestones; closed symbols represent completed milestones or activities.

Figure 2. Cumulative Expenditure History



APPENDIX A

SUMMARY OF TASK ASSIGNMENTS

1. General Scope of Effort

The work to be performed by The Aerospace Corporation for the DOE/TEC is confined to the following basic task areas.

Task 1 - Technical Support of Ongoing Research and Development Programs in Energy Efficient Transportation Systems

Task 2 - Analysis for the Future Commercialization of Transportation Technologies

Task 3 - New Concept Evaluation Program Support

Task 4 - Technical Evaluation of New Concepts, Inventions, and Ideas

Task 5 - Assessment of Technological and Other Factors on the Implementation and Utilization of Transportation in the United States

Task 6 - Program Planning Analysis and Documentation

Within each of these basic areas, Aerospace may be called upon to perform analyses, assessments, evaluations, plans, reports, etc., as required to support DOE/TEC programs.

2. Specific Assignments to Date and Schedule Requirements

The following assignments have been in effect or initiated since the inception of work on June 15, 1978.

2.1 Heat Engine Systems

2.1.1 Automotive Technology Assessment Study (JO 7751)

Section 310 of the Automotive Propulsion Research and Development Act of 1978 (Title III of Public Law 95-238) requires that DOE/TEC submit an annual report to Congress on the activities DOE/TEC has performed in implementing the provisions of the Act. The effort in this task is to assist DOE/TEC in preparing this annual report, by means of technology assessments,

planning, and report writing and coordination. A rough draft of the report is to be completed by November 30, 1978; the final report is to be published by February 1979.

2.1.2 Technical Responses to Inquiries (JO 7752)

DOE/TEC receives many inquiries and suggestions concerning transportation energy conservation from inventors, Congressional offices, and concerned citizens. The effort in this task is to provide quick-response support to DOE/TEC by reviewing the technical content of such letters of inquiry and preparing technical inputs for letter responses. This activity is expected to be of a continuing nature throughout the contract period.

2.1.3 Highway Systems Analysis Support (JO 7753)

As a consequence of program changes or developments in DOE/TEC or industry R & D status, DOE/TEC is required to investigate, evaluate, and report on diverse technological issues or topics. The effort in this task is to provide technical analysis and assessment support to DOE/TEC in completing these many and varied requirements. The time involved varies, depending upon the specific area of investigation, and may be as short as a few weeks or as long as six months.

Task assignments to date include:

1. Fuel Consumption and Emission Characteristics of Light-duty Diesel and Stratified Charge Engines
2. First-year Fuel Consumption of New Automobiles, Light-duty Trucks, Heavy-duty Trucks, Buses, and Motorcycles
3. Summary of Diesel-related Work in Areas of Technology Development and Health Effects
4. DOE/TEC Technical Contributions to DOT's 1979 Annual Report to Congress
5. Preparation of Prospectus of Requirements for Vehicle Systems Program
6. Evaluation of Numerous Unsolicited Proposals
7. Development of Demonstration Program Plan for Gas Turbine and Stirling-engine-powered Automobiles

Items 1 and 2 above were initiated during the previous contract and are being continued and completed during the present contract.

2.1.4 Evaluation of Specific Engines/Systems (JO 7754)

This JO is reserved for prospective assignments of evaluations of specific engines and/or vehicle systems which are deemed to require an extensive level of effort and/or require a separate accounting of expended effort. One assignment in this category has been made to date.

1. Evaluation of Stirling-engine-powered Vehicle Provided by United Stirling of Sweden

2.1.5 Special Heat Engine System Studies (JO 7755)

This JO is reserved for prospective assignments of longer-range study activities which are expected, at the outset, to result in formal publications of The Aerospace Corporation. No assignments have yet been made in this category.

2.2 Alternative Fuels Utilization

2.2.1 Distillery Impact Study (JO 7756)

The DOE Alcohol Fuels Program Plan (Document No. DOE/US-0001/2, March 1978) establishes DOE's role and plans for establishing alcohol fuel availability and end-use commercialization potential. The effort in this task is to determine the role that the distilling industry can fill in producing alcohol for fuel use. The study is examining the technological, economic, institutional, and environmental characteristics of the fermentation industries producing industrial ethanol and distilled spirits. The study is scheduled for completion in October 1978.

2.2.2 Immediate Action Studies Support (JO 7757)

The DOE Alcohol Fuels Program Plan incorporates the requirement for a series of studies to examine and help resolve key technological, economic, environmental, and institutional issues that obstruct or cloud commercialization decisions. As a consequence, an Alcohol Fuels Policy Review by DOE has been instituted. The effort in this task is to provide analysis

support to the currently-operative Alcohol Fuels End-use Task Force and to any subsequent immediate-action studies in this area. The current effort for the End-use Task Force is expected to end by 30 September 1978.

2.2.3 Fuel Economy Improvement Potential Study (JO 7758)

The effort in this two-phase study is to determine the combustion efficiency potential of spark ignition engines and the potential impact of fuel modifications. Phase I involves the analysis of the combustion losses of several late model engines, and is expected to be completed by the end of September 1978. Phase II involves a theoretical analysis of combustion inefficiencies as affected by variations in fuel heat release rate. A completion date for Phase II has not yet been determined.

2.2.4 Alternative Fuels Analysis Support (JO 7759)

The effort in this task is directed to providing analysis and assessment support in response to changing program needs or the requirement to respond to technological questions raised by developments in DOE and industry programs. The time involved varies, depending upon the specific area of investigation, and is expected to range from a few weeks to several months.

Task assignments to date include:

1. Assessment of H_2 vs. Battery-powered Automobiles (this is a continuation of study initiated under previous contract)

2. Preparation of Project Plan for Reliability Fleet Testing of Alcohol/Gasoline Blends

2.2.5 Special Alternative Fuels Studies (JO 7760)

This JO is reserved for prospective assignments of longer-range study activities which are expected, at the outset, to result in formal publications of The Aerospace Corporation. No assignments have yet been made in this category.

2.3 Nonhighway Transport Systems

2.3.1 Commercial Aviation Fuel Economy Study (JO 7761)

The effort in this study task is to examine commercial aviation operational policies and fuel conservation strategies and identify those

that are the most beneficial and deserving of DOE support. The basic study effort and report rough draft were completed under the previous contract. Effort is currently under way to define the next level of study activity required and to define a meaningful schedule for accomplishing the work.

2.3.2 General Aviation Fuel Economy Study (JO 7762)

This JO is reserved for prospective assignment of a study which would examine the operational policies and fuel conservation strategies which would be most beneficial to the category of general aviation. It would thus parallel the Commercial Aviation Fuel Economy Study noted above in Section 2.3.1. No assignment has yet been made in this category.

2.3.3 Nonhighway Systems Analysis Support (JO 7763)

This JO is reserved for prospective assignments of analysis and assessment support in the air, rail, pipeline, and marine transport sectors, as required. One assignment has been made to date.

1. Optimization of Rail Car Structures for Energy Conservation (analysis and assessment of evaluation criteria)

2.4 New Concepts Evaluation (JO 7764)

The effort in this task is (1) to conduct technical evaluations of new concepts, inventions, and ideas offered to DOE/TEC by industry, universities, government, and individuals, and (2) to conduct feasibility studies for the implementation and effective utilization of developments arising from the New Concepts Program of TEC. This activity is of a continuing nature and is expected to continue throughout the contract period.

2.5 Electric and Hybrid Vehicle R & D

On November 6, 1978, the EHV R & D support tasks were restructured as defined below in Sections 2.5.1 through 2.5.3. Refer to the Third Monthly Progress Report of October 1978 (7769.78.MGH-229) for assignments prior to November 6, 1978.

2.5.1 EHV Program Coordination Support (JO 7765)

In accordance with the provisions of the Electric and Hybrid Vehicle (EHV) Research, Development and Demonstration Act of 1976, DOE/TEC

has instituted an R & D program which will culminate in the demonstration of up to 10,000 vehicles in in-use service.

DOE/TEC has established an EHV R & D Coordinating Committee to facilitate coordination and management of the various participants in the R & D program. The effort in this task is to provide close support to that Committee in the areas of analysis, assessment, and planning. This activity is of a continuing nature and is expected to continue throughout the contract period. Specific task assignments as of November 6, 1978 include:

1. R & D Committee Support

   This task is a continuation and expansion of the previous assignment in this area. The expanded effort consists of careful review of laboratory and contractor monthly reports to advise the Committee of potential problem areas.

2. Level II R & D Plan

   This is anticipated to be a major effort during the first half of FY 79.

3. Goals Study

   This new task is to be a principal study during the year. Its thrust is the formulation of goals for the EHV R & D Program based on the Level I and Level II Plans.

4. Project Reporting System

   This new task entails working with HQ staff to devise a project reporting system to allow HQ management closer cognizance and control over the field projects.

5. EHV Annual Report

   This new task involves the preparation of the R & D Program chapter in the next EHV Annual Report.

6. Technology Brochure Preparation

   This task involves assistance in the preparation of a brochure describing the EHV Technology Program.

7. Miscellaneous Support Activities

   This task involves various "quick-support" activities requested by the R & D Coordinating Committee. One potential task is the preparation of another film on the Near-term Electric Vehicle program. Other activities in this area will be assigned as they occur during the year.

2.5.2 Electric and Hybrid Vehicle Analysis Support (JO 7766)

This task area encompasses assignments of analysis and assessment of electric and hybrid vehicle systems and components. Assignments as of November 6, 1978 include:

1. Planning Grant Technical Analyses

   Technical analyses of the next round of Planning Grant applications are the scope of this task.

2. Loan Guaranty Technical Analyses

   It is anticipated that we will be requested to provide technical analyses and evaluations of applications for loan guarantees.

3. Proposal/Report/Correspondence Analyses

   This is an expansion of work in the preparation of replies to incoming correspondence. This will include more detailed analyses of proposals and reports, reviews of the DOE EHV Annual and Quarterly Reports, and reviews of miscellaneous DOE reports.

4. Purdue Resource Allocation Model

   This task entails critiquing and assisting in the subsequent implementation of the Purdue University Opportunity/Risk Assessment Study.

5. Corporate Average Fuel Economy Analysis

   It is anticipated that this analytical study will continue and expand during the year as Congressional hearings are conducted and legislative proposals are offered.

2.5.3 Electric and Hybrid Vehicle Performance Standards Support (JO 7767)

This task involves analyses of the current state of the art of the performance capabilities of EHV technology to provide a basis for recommending future-year EHV performance standards. It will provide DOE with a defensible basis for setting future standards. The first cycle is to be completed by December 1979.

2.6 Technology Assessment and Implementation (JO 7768)

This JO is reserved for prospective assignments of analysis and assessment support for the Technology Assessment and Implementation Branch. This Branch has not committed funds to the contract; no assignments have yet been requested.

2.7 Technical Program Documentation

2.7.1 Program Planning and Analysis (JO 7769)

This JO is reserved for prospective assignments of analysis and planning support for TEC division-wide activities or for those planning activities which overlap Branch functions. No assignments have yet been made.

2.7.2 Management Review and Control Documentation (JO 7770)

This JO is reserved for prospective assignments of planning and documentation support for preparation of TEC's annual MRCD. No assignments have yet been made.

3. Reporting and Coordination

As can be noted from the discussion in Section 2 above, the preponderance of assignments involves technical analysis support of the quick-response, relatively short-duration nature. These work efforts are under way simultaneously for five Branches of TEC, and the results are often incorporated into ongoing TEC activities, as completed. The principal reporting mechanism from Aerospace to TEC pertaining to the analysis results of a given effort is a "memorandum report" transmitted by letter from Aerospace to TEC; the transmittal letter bears an identification number which incorporates the JO under which the work was performed.

In cases where the end product is more extensive, it may be published as an Aerospace technical report or as a DOE/TEC report, depending upon the wishes of the cognizant branch chief.

A Monthly Progress Report (MPR) is the principal tool for tracking (1) the tasks assigned to Aerospace, (2) the status and progress made in each such assignment, and (3) the expenditure of funds in each task area. For historical and record-keeping purposes, each such report will include an Appendix of Assignments and an Appendix of Reporting (see Appendix B of this report). In this manner, each branch chief can easily track assignments made and results received. In the expenditure area, each MPR will contain a breakdown, by JO, of both monthly and cumulative expenditures to date.

APPENDIX B

Summary Table of Principal Reporting Activities of
The Aerospace Corporation under Contract No. EM-78-C-03-2184
(Includes formal reports, drafts, and memorandums or other
working papers transmitted to DOE/TEC personnel to document
progress on assigned task activities)

Period Through 31 March 1979

Job Order Number	Description	Type of Report	Recipient at DOE/TEC
7751	Automotive Technology Assessment Study		
	1. Comments and Suggestions Pertaining to Format and Content Development of First Annual Report to Congress (Title III of Public Law 95-238)	Briefing (23 pages) to DOE/NASA Management Review Meeting, 6-27-78	Lombardi, et al.
	2. First "Strawman" Rough Draft of Annual Report to Congress on Implementation of Public Law 95-238	Draft report, 7751.78.MGH-222, 1 November 1978	Lombardi
	3. Second "Strawman" Rough Draft of Annual Report to Congress on Implementation of Public Law 95-238	Draft report, 7751.78.WUR.125 20 December 1978	Lombardi
	4. Third Draft of Annual Report to Congress on Implementation of Public Law 95-238	Draft Report, 7751.79.WUR.128 4 January 1979	Lombardi
	5. Fourth Draft of Annual Report to Congress on Implementation of Public Law 95-238	Draft report, 7751.79.WUR.02 5 January 1979	Lombardi
	6. Fifth Draft of Annual Report to Congress on Implementation of Public Law 95-238	Draft report, 7751.79.WUR.07 29 January 1979	Lombardi

Job Order Number	Description	Type of Report	Recipient at DOE/TEC
7751	Automotive Technology Assessment Study (continued)		
	7. February 2 Draft of Annual Report to Congress on Implementation of Public Law 95-238	Draft report, 7751.79.WUR.22 2 February 1979	Lombardi
	8. February 27 Draft of Annual Report to Congress on Implementation of Public Law 95-238	Draft report, 7751.79.WUR.30 26 February 1979	Lombardi

Job Order Number	Description	Type of Report	Recipient at DOE/TEC
7752	Technical Responses to Inquiries	(Transmittal Letters)	
	1. One evaluation	7752.78.MGH-120 6-15-78	Van Tassel
	2. One evaluation	7752.78.MGH-122 6-16-78	Van Tassel
	3. Four evaluations	7752.78.MGH-123 6-20-78	Van Tassel
	4. One evaluation	7752.78.MGH-126 6-21-78	Van Tassel
	5. Seven evaluations	7752.78.MGH-129 6-23-78	Van Tassel
	6. Eight evaluations	7752.78.MGH-130 6-27-78	Van Tassel
	7. Two evaluations	7752.78.MGH-131 6-28-78	Van Tassel
	8. Three evaluations	7752.78.MGH-132 6-29-78	Van Tassel
	9. Six evaluations	7752.78.MGH-135 7-6-78	Van Tassel
	10. Seven evaluations	7752.78.MGH-141 7-12-78	Van Tassel
	11. Seven evaluations	7752.78.MGH-142 7-13-78	Van Tassel
	12. One evaluation	7752.78.MGH-143 7-14-78	Van Tassel
	13. Three evaluations	7752.78.MGH-145 7-17-78	Van Tassel
	14. Two evaluations	7752.78.MGH-148 7-20-78	Van Tassel
	15. Two evaluations	7752.78.MGH-149 7-21-78	Van Tassel

Job Order Number	Description	Type of Report	Recipient at DOE/TEC
7752	Technical Responses to Inquiries (continued)	(Transmittal Letters)	
	16. Seven evaluations	7752.78.MGH-151 7-25-78	Van Tassel
	17. One evaluation	7752.78.MGH-152 7-26-78	Van Tassel
	18. Five evaluations	7752.78.MGH-154 8-1-78	Van Tassel
	19. Two evaluations	7752.78.MGH-155 8-3-78	Van Tassel
	20. One evaluation	7752.78.MGH-156 8-4-78	Van Tassel
	21. Two evaluations	7752.78.MGH-159 8-9-78	Van Tassel
	22. Six evaluations	7752.78.MGH-165 8-15-78	Van Tassel
	23. One evaluation	7752.78.MGH-169 8-17-78	Van Tassel
	24. Four evaluations	7752.78.MGH-175 8-21-78	Van Tassel
	25. Two evaluations	7752.78.MGH-176 8-22-78	Van Tassel
	26. Three evaluations	7752.78.MGH-183 8-25-78	Van Tassel
	27. Two evaluations	7752.78.MGH-187 8-30-78	Van Tassel
	28. Two evaluations	7752.78.MGH-188 8-31-78	Van Tassel
	29. Two evaluations	7752.78.MGH-194 9-8-70	Van Tassel
	30. Two evaluations	7752.78.MGH-195 9-11-78	Van Tassel

Job Order Number	Description	Type of Report	Recipient at DOE/TEC
7752	Technical Responses to Inquiries (continued)	(Transmittal Letters)	
	31. Two evaluations	7752.78.MGH-197 9-13-78	Van Tassel
	32. Seven evaluations	7752.78.MGH-199 9-15-78	Van Tassel
	33. One evaluation	7752.78.MGH-202 9-19-78	Van Tassel
	34. One evaluation	7752.78.MGH-203 9-20-78	Van Tassel
	35. Two evaluations	7752.78.MGH-204 9-21-78	Van Tassel
	36. One evaluation	7752.78.MGH-205 9-25-78	Van Tassel
	37. Two evaluations	7752.78.MGH-207 9-28-78	Van Tassel
	38. One evaluation	7752.78.MGH-208 10-2-78	Van Tassel
	39. One evaluation	7752.78.MGH-209 10-5-78	Van Tassel
	40. Two evaluations	7752.78.MGH-213 10-16-78	Van Tassel
	41. Four evaluations	7752.78.MGH-214 10-19-78	Van Tassel
	42. One evaluation	7752.78.MGH-216 10-24-78	Van Tassel
	43. One evaluation	7752.78.MGH-217 10-25-78	Van Tassel
	44. Three evaluations	7752.78.MGH-219 10-26-78	Van Tassel

Job Order Number	Description	Type of Report	Recipient at DOE/TEC
7752	Technical Responses to Inquiries (continued)		
	45. Three evaluations	7752.78.MGH-220 10-27-78	Van Tassel
	46. One evaluation	7752.78.MGH-221 10-31-78	Van Tassel
	47. Three evaluations	7752.78.MGH-223 11-2-78	Van Tassell
	48. One evaluation	7752.78.MGH-235 11-17-78	Van Tassell
	49. One evaluation	7752.78.MGH-236 11-20-78	Van Tassell
	50. Three evaluations	7752.78.MGH-241 11-30-78	Van Tassell
	51. Two evaluations	7752.78.MGH-243 11-30-78	Van Tassell
	52. One evaluation	7752.78.MGH-244 12-5-78	Van Tassel
	53. Five evaluations	7752.78.MGH-251 12-12-78	Van Tassel
	54. One evaluation	7752.78.MGH-255 12-20-78	Van Tassel
	55. One evaluation	7752.78.MGH-256 12-26-78	Van Tassel
	56. Three evaluations	7752.78.MGH-257 12-27-78	Van Tassel
	Note: Commencing in January 1979, all evaluations were telefaxed directly from Los Angeles to Germantown, Maryland, as received.		

Job Order Number	Description	Type of Report	Recipient at DOE/TEC
7753	Highway Systems Analysis Support		
	1. Review of SRI Draft Report, "Diesel Cars in the United States"	Memorandum Report 7753.78.WUR.66 7-11-78	Maxfield
	2. Test Plan for Demonstration and Evaluation of Gas Turbine Engine Powered Automobiles	Memorandum Report 7753.78.WUR.79 7-14-78	Themak
	3. Variables to Consider in Auto Fuel Consumption Projections	Memorandum Report 7753.78.MGH-144 7-14-78	Thur
	4. Review of Proposal, "Automobile Fuel Injection Device"	Memorandum Report 7753.78.WCG-18 7-17-78	Lombardi
	5. Review of Proposal, "The Otto-Atkinson Engine"	Memorandum Report 7753.78.WCG-20 7-18-78	Lombardi
	6. Review of Proposal, "Development and Demonstration of Medium Duty Trucks Powered by Open Chamber Stratified Charge Engines"	Memorandum Report 7753.78.MGH-157 8-7-78	Themak
	7. Diesel Engine Research and Development Status, and Requirements	Briefing (40 pages) to DOE/TEC in Washington, D.C. 8-11-78	Brogan, et al.
	8. Review of Proposal, "Hydraulic Power Management System for Automotive Applications"	Memorandum Report 7753.78.WCG-23 8-15-78	Themak
	9. "DOE Comments on the Prospective DOT 1979 Report to Congress" (First Draft)	Memorandum Report 7753.78.MGH-168 8-16-78	Lombardi
	10. Review of Proposal, "Improvement of Automotive Coolant Pump Performance"	Memorandum Report 7753.78.WCG-24 8-18-78	Themak

Job Order Number	Description	Type of Report	Recipient at DOE/TEC
7753	Highway Systems Analysis Support (continued)		
	11. "DOE Comments on the Prospective DOT 1979 Report to Congress" (First Draft of 34-page Briefing)	Memorandum Report 7753.78.MGH-186 8-29-78	Lombardi
	12. Final Draft of Briefing, "DOE Comments on the Prospective DOT 1979 Report to Congress" (34 pages)	Briefing on Sept. 13, 1978 at DOT Hdqrtrs.	Lombardi, Thur, Brogan
	13. Final Draft of 85-page document, "DOE Comments on the Prospective DOT 1979 Report to Congress"	25 copies delivered on Sept. 13, 1978	Lombardi
	14. Review of Proposal, "Mini-Sam Propulsion System," I.D. No. THP 7800838	Memorandum Report, 7753.78.WCG.27, 1 September 1978	Lombardi
	15. Rebuttal to Proposal Evaluation, "Britalus Continuous Combustion Rotary Engine"	Memorandum Report, 7753.78.WCG.28, 4 September 1978	Lombardi
	16. Review of Proposal, "Fuel Injection Systems"	Memorandum Report, 7753.78.WCG.29, 7 September 1978	Themak
	17. Review of Proposal, "Orbital Hydrostatic Accumulating Drive"	Memorandum Report, 7753.78.WCG.30 11 September 1978	Lombardi
	18. Review of Proposal, "Ceramic Helical Expanders for Brayton Cycle Heat Engines"	Memorandum Report, 7753.78.RRB.02, 15 September 1978	Thur
	19. Review of Proposal, "Fuel Savings Project"	Memorandum Report, 7753.78.WCG.31 18 September 1978	Lombardi
	20. Review of Proposal, "Brinkerhoff Split Cycle Engine"	Memorandum Report, 7753.78.RRB.03, 25 September 1978	Themak
	21. First draft, "Diesel Engine Research and Development Status and Needs"	Memorandum Report, 7753.78.WUR.102, 11 September 1978	Brogan

Job Order Number	Description	Type of Report	Recipient at DOE/TEC
7753	Highway Systems Analysis Support (continued)		
	32. Review of Proposal, "A Reciprocating Brayton Cycle Engine" (Warren Engine)	Memorandum Report, 7753.78.WCG.35 16 November 1978	Lombardi
	33. Final Report, "Diesel Engine Research and Development Status and Needs"	Aerospace Report No. ATR-78(7753)-1 September 1978	Brogan, et al.
	34. Review of Proposal, "Synthetic Atmosphere Engine Development," by S. C. Plotkin	Memorandum Report, 7753.78.WUR.123 7 December 1978	Thur
	35. Review of Proposal, "Adkins Rotary Engine"	Memorandum Report 7753.78.GJM.32 7 December 1978	Lombardi
	36. Review of Proposal, "Design and Development of Improved Stirling Cycle Engine," by Don S. Slack (THP-7900091)	Memorandum Report 7753.78.RBB.10 19 December 1978	Thur
	37. Transmittal of Changes to Diesel Report	Memorandum 7753.78.WUR.122 6 December 1978	Lombardi
	38. Transmittal of Masters for Diesel Report, ATR-78(7753)-1	Memorandum 7753.78.WUR.127 21 December 1978	Lombardi
	39. Review of Proposal, "Latent Heat Re-use System for Steam Engines," by Earling Steiner (THP-7900076)	Memorandum Report 7753.78.WCG.38 29 December 1978	Lombardi
	40. Masters and six copies of report, "Fuel Consumption and Engine Horsepower Projections for Highway Transportation Sector"	Aerospace Report No. ATR-78(7753)-2 April 1978	Lombardi
	41. Review of Proposal, "Determination of Two Phase Turbine Engine Characteristics" (TNP 7900261	Memorandum Report 7753.79.WCG.02 15 January 1979	Lombardi
	42. Draft inputs to DOE's Diesel Briefing Book	Memorandum Report 7753.79.WUR.06 22 January 1979	Lombardi

Job Order Number	Description	Type of Report	Recipient at DOE/TEC
7753	Highway Systems Analysis Support (continued)		
	43. Review of "Passenger Automobile Weight Projections of 1983-1986" (Corporate-Tech Planning, Inc.)	Memorandum Report 7753.79.JJD.04 29 January 1979	Lombardi
	44. Review of "Documentation of Fuel Economy and Cost Estimates Used in the Analysis of NEP II Automotive Conservation Initiatives" (Energy and Environmental Analysis, Inc.)	Memorandum Report 7753.WUR.79.31 26 February 1979	Lombardi
	45. Review of "EPA Draft Regulatory Analysis Report for Diesel Technology and Cost"	Memorandum Report 7753.WUR.79.33 2 March 1979	Themak
	46. Review of Proposal, "Gearbine Rotary Engine"	Memorandum Report 7753,RBB.79.05 8 March 1979	Lombardi
	47. Draft response to Congressman Findley regarding carburetor float issue	Memorandum Report 7753.79.WCG.09 23 March 1979	Lombardi
	48. Review of Proposal, "Dual-Cycle Heat Engine," submitted by David M. Van Den Einde	Memorandum Report 7753.79.RBB.07 26 March 1979	Lombardi
	49. Review of Proposal, "Pentagonal Electromagnetic Engine"	Memorandum Report 7753.79.WCG.11 28 March 1979	Lombardi
	50. "Alternate Fuel Economy Measures and Transportation Mileage Optimization"	Memorandum Report 7753.79.WUR.34 14 March 1979	Brogan
	51. Crude Oil Savings (in Bar Chart format)	FAXED Chart 23 March 1979	Brogan

Job Order Number	Description	Type of Report	Recipient at DOE/TEC
7756	Distillery Impact Study		
	1. Report entitled "The Potential Role of the Distilling Industry in Supplying Ethanol Fuel," by H. M. White	Rough Draft dated January 1979	Ecklund
	2. Final report entitled "The Potential Role of the Distilling Industry in Supplying Ethanol Fuel," by H. M. White	Aerospace Report No. ATR-79(7756)-1 (25 copies plus report masters)	Ecklund

Job Order Number	Description	Type of Report	Recipient at DOE/TEC
7757	Immediate Action Studies Support 1. Typewritten drafts of various sections of report for End-use Subcommittee of the Alcohol Fuels Policy Review during period August 7, 1978 to October 17, 1978	Memorandum of Record 7757.78.MGH-237 27 November 1978	Ecklund

Job Order Number	Description	Type of Report	Recipient at DOE/TEC
7758	Fuel Economy Improvement Potential Study		
	1. Draft of "Effect of Combustion Burn Time on the Efficiency of Spark Ignition Engines"	Draft Report, 7758.79.GJM.03 9 February 1979	Fleming

Job Order Number	Description	Type of Report	Recipient at DOE/TEC
7759	Alternative Fuels Analysis Support		
	1. Review of LLL Report, "Energy Storage Systems for Automobile Propulsion"	Memorandum Report 7759.78.JJD.17 7-17-78	Ecklund
	2. Project Plan for Reliability Fleet Testing of Alcohol/Gasoline Blends (First Draft)	Memorandum Report 7759.78.MGH-153 7-31-78	Ecklund
	3. Detailed Plans for First Year's Activities of Reliability Fleet Test Program	Memorandum Report, 7759.78.MGH-232 14 November 1978	Ecklund
	4. Iniated Efforts to Secure Services of SWRI to Assist in Reliability Fleet Test Planning	Memorandum 7759.78.MGH-248 11 December 1978	Ecklund
	5. Submitted paper, "Hydrogen Powered Versus Battery Powered Automobiles," for publication to International Journal of Hydrogen Energy	Memorandum Report 7759.78.JJD.38 14 December 1978	Nejat Veziroglu
	6. Report of CRC Meeting in Detroit on 12 December 1978	H. White memo, 14 December 1978	Ecklund
	7. Report of Visit to Southwestern Bell and BETC	Memorandum 7759.78.HMW 28 December 1978	Ecklund
	8. Updated Project Plan for Reliability Fleet Testing of Alcohol/Gasoline Blends	Document dated 30 March 1979	Ecklund
	9. Briefing package, "DOE Reliability Fleet Test Program for Alcohol/Gasoline Fuels" (for presentation to Contractors Coordination Meeting, April 24-26, 1979, Dearborn, Michigan)	300 copies of Briefing Book	Ecklund

Job Order Number	Description	Type of Report	Recipient at DOE/TEC
7761	Commercial Aviation Operational Energy Conservation Strategies		
	1. Replies to comments of Delta Air Lines and Others	Memorandum Report, 7761.78.RRC.19, 27 September 1978	Alpaugh
	2. Task Descriptions for Future Work in Extension of Current Study	Memorandum Report, 7761.78.RRC.24 5 December 1978	Alpaugh
	3. Briefing of "Examination of Commercial Aviation Operational Energy Conservation Strategies"	Briefing Book 26 January 1979	Alpaugh
	4. Preliminary Work Statement Package for "Joint Continental Airlines/Aerospace/DOE Program for Reduced DC-10 Fuel Consumption"	Memorandum Report, 7761.79.RRC.02 23 January 1979	Alpaugh
	5. Report Masters, "Examination of Commercial Aviation Operational Energy Conservation Strategies"	Memorandum Report, 7761.79.WUR.08 29 January 1979	Alpaugh
	6. Review of "Aircraft Engine Compressor Blade Erosion Studies" (unsolicited proposal by Nielsen Engineering and Research Company, Inc.)	Memorandum Report, 7761.79.RRC.24 7 February 1979	Alpaugh
	7. Draft of "Improved Airframe Maintenance Program (IAMP), including Preliminary Work Statement and Schedule Package	Memorandum Report, 7761.79.RRC.25 9 February 1979	Metzger of Alaska Airlines
	8. Suggested changes to report, "Examination of Commercial Aviation Operational Energy Conservation Strategies"	Memorandum Report 7761.79.RRC.27 7 March 1979	Alpaugh

Job Order Number	Description	Type of Report	Recipient at DOE/TEC
7763	Nonhighway Systems Analysis Support		
	1. Calculations of Train Resistance and Horsepower Requirements of Unit Train	Memorandum Report, 7763.78.JJD.21 25 September 1978	Alpaugh

Job Order Number	Description	Type of Report	Recipient at DOE/TEC
7764	New Concepts Evaluation (Proposals)		
	1. "Vehicle Drive Systems Including a Phased Rotary Type Engine with an Infinitely Variable Gear Ratio Automatic Transmission" (TNP-7800608)	Memorandum Report 7764.78.WCG-16 6-20-78	Starr
	2. "Development of the Wall Thermodynamic Cycle" (THK-80014)	Memorandum Report 7764.78.WCG-17 6-23-78	Starr
	3. "Research and Development of Concept Leading to an Automotive Alternator with Significantly Improved Efficiency and Weight" (TNP-7800582	Memorandum Report 7764.78.WCG-22 8-3-78	Starr
	4. "An Energy Conserving Pollution Free Automobile Exhaust Device" (TNP-780074)	Memorandum Report 7764.78.WCG-25 8-14-78	Starr
	5. "A Study of a Gasoline Economy Car of Unique Design" (THP-7801104)	Memorandum Report, 7764.78.WCG.33, 9-13-78	Starr
	6. "Graybill Oil Rectifier"	Memorandum Report, 7764.78.GJM-28 28 November 1978	Starr
	7. "Diesel Pulsejet Engine for Pleasure Boats," (TNP-7900143)	Memorandum Report, 7764.78.WCG.37 14 December 1978	Starr
	8. "Optimization of Rail Car Structures for Energy Conservation," A Rebuttal	Memorandum Report 7764.78.WUR.124 14 December 1978	Alpaugh

Job Order Number	Description	Type of Report	Recipient at DOE/TEC
7765	EHV Program Coordination Support		
	1. Meeting Summary, First EHV R & D Work Session	Memorandum Report 7765.78.rh.26 6-26-78	Kirk
	2. Meeting Summary, Second EHV R & D Work Session and EHV Performance Parameter Table	Memorandum Report 7765.78.rh.27 7-6-78	Kirk
	3. Revised Meeting Summary, Second EHV R & D Work Session	Memorandum Report 7765.78.rh.29 7-12-78	Kirk
	4. Small Business Planning Grant Review	Memorandum Report 7765.78.rh.31 7-24-78	Kirk
	5. Inclusion of Electric Vehicles Into the Corporate Average Fuel Economy Standards	Memorandum Report 7765.78.rh.33 8-3-78	Kirk
	6. Revised Briefing, "The Implications of Amending the Corporate Average Fuel Economy Standards to Include Electric and Hybrid Vehicles"	Briefing Book 7765.rh.79.04 17 January 1979	Kirk
	7. Meeting Notes from January 18, 1979 meeting with GE, Chrysler, and Globe-Union	Memorandum Report, 7765.rh.79.05 19 January 1979	Kirk

Job Order Number	Description	Type of Report	Recipient at DOE/TEC
7770	Management Review and Control Documentation		
	1. Revision of 1978 MRCD masters (originally prepared under previous contract)	Memorandum Report, 7770.WUR.78.103, 12 September 1978	Wilson