NINTH PROGRESS REPORT

(for April 1979) DOE/CS/52184--T5

TECHNICAL ANALYSIS SUPPORT FOR TRANSPORTATION ENERGY CONSERVATION DIVISION OF DOE

10 May 1979

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

Prepared by

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for the

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

DISCLAIMER

NINTH PROGRESS REPORT

(for April 1979)

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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 30 April 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 April 30, 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. No further comments have been received.

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 April, technical responses were prepared for 21 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 has been 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 government

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: A paper entitled "Diesel Engine Research and Development Status" was prepared and presented at the DOE Highway Vehicle Systems Contractors' Coordination Meeting which was held on April 24-26 at Dearborn, Michigan.

At the request of Mr. Themak, EPA's review comments on the preliminary draft of DOE's Fact Book on Issues Surrounding Federal Regulation of Light Duty Diesel Vehicles were critically examined. A report summarizing our position was transmitted to Mr. Themak on 17 April 1979.

Work on the second annual report entitled "Diesel Engine Research and Development Status and Needs" has been initiated.

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 draft final report has been completed and is currently undergoing in-house review.

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. A comprehensive study of relevant issues is nearing completion.

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 Messrs. Thur, Lombardi, and Themak, four unsolicited proposals were reviewed during this report period. It was recommended that DOE not support the development of the proposed concepts.

The first proposal, entitled "Electronic Fuel Saver and Emission Control System," involves the development of an electrically-powered fuel pre-heater to enhance fuel vaporization in spark ignition engines. The fuel savings resulting from the installation of this device in late-model automobiles are judged to be near zero, and safety would be seriously compromised.

The second proposal, entitled "Development of a Mechanically Simple, Fuel Efficient, and Environmentally Safe Internal Combustion Engine (Enclosed Turbine Engine)," is concerned with the development of a two-stroke diesel engine using crankcase compression for scavenging. This engine has no fuel consumption advantage over existing diesel engines, and is bulkier and heavier than current in-line or 'V' designs.

The third proposal, entitled "Proposed Improvements in Automotive Engines," involves the incorporation of a number of well known techniques into automobile engines. These techniques include turbocharging, direct cylinder fuel injection, twin exhaust manifolds, valve and port modifications, and increased exhaust valve overlap. While turbocharging and fuel injection are known to improve vehicle fuel economy, and are being seriously considered by the automobile industry, the other proposed modifications offer little fuel conservation potential.

The fourth proposal, entitled "Research and Development Project for a High Efficiency Rankine Cycle Engine," features the use of a highly efficient reciprocating expander with reheat and combustion air preheating. While the

thermal efficiency goal of 27 percent is considerably higher than the efficiency achieved in other automotive Rankine engine designs, it is not sufficiently high to produce fuel savings relative to future conventional and alternative engines.

At the request of Dr. Fleming, an unsolicited proposal entitled "Stability of Hydrocarbon Fuels" was evaluated. Because of a lack of identifiable energy losses due to fuels deterioration in storage, it was recommended that DOE not fund the proposed study of storage lifetime of fuels.

At the request of Mr. Alpaugh, an unsolicited proposal entitled "Development of a Basic Design of an Advanced Wind-driven Cargo Ship" was evaluated. The proposed use of newly designed masts and sails for a selected group of cargo vessels appears to be attractive and worthy of more detailed evaluation. Therefore, it was recommended that DOE solicit more detailed information from the proposer, and conduct an analysis of all issues involved, including trade routes, fuel price projections, potential cargo markets, and energy savings.

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 was completed and displayed at the Highway Vehicles Contractors' Coordination Meeting during April 24-26, 1979.

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.

Further support is anticipated for the forthcoming "summit" meeting currently scheduled for mid- to late-May.

3.1.3.8 Carburetor Float Investigation

Objective: To investigate potential carburetor float malfunctioning, and to determine the effect on Air-fuel mixture and vehicle fuel economy.

Status: A number of defective carburetor floats, provided by Congressman Paul Findley's office, are being tested by Aerospace to determine their fuel absorption characteristics and related weight changes. To provide comparison data, a number of new floats are also being tested. The float manufacturer has been contacted and has supplied specification data for the floats under examination.

3.2 Alternative Fuels Utilization

3.2.1 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 2 April 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. A summary report on both phases is in preparation.

3.2.2 Alternative Fuels Analysis Support (JO 7759)

3.2.2.1 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 was received from Mr. Ecklund in February. Final editing and typing of the masters are scheduled for completion toward the latter part of May.

3.2.2.2 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 has been 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 which outlined the program was given at the Highway Vehicle Systems Contractors' Coordination Meeting in Dearborn, Michigan, April 24-26, 1979.

3.2.2.3 Alcohol/Diesel Fuel Emulsions Study

Objective: To review past and ongoing research in the areas of diesel fuel emulsions with alcohols and water, and to identify further research needs for future DOE consideration.

Status: A literature search has been initiated, and a study plan is in preparation.

3.2.3 Nonhighway Transport Systems

3.2.3.1 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. During this report period, work statements were prepared, delineating the tasks to be performed by Continental and Alaska Airlines, who were selected as subcontractors for this effort. Airframe audit forms were developed for use by Continental Airlines in tabulating airframe discrepancies of their DC-10 fleet.

Final changes on the report entitled "Examination of Commercial Aviation Operational Energy Conservation Strategies" are nearly complete, and the report masters will be mailed to the DOE project monitor early in May for publication of the report as a DOE document.

At the request of Mr. Alpaugh, a proposed program plan for the monitoring of aircraft fuel economy in the commercial air transport sector was developed and forwarded to the DOE. The plan is composed of a set of tasks to be accomplished over a one-year performance period. Culmination of the first year's work would result in the development of a computer program, and the use of the program to assess past efforts by the commercial air transport sector aimed at improving aircraft fuel economy through application of operational strategies. Subsequent follow-on use of the computer program would result in issuance of quarterly and annual reports, evaluating the efficiency of jet fuel usage within the commercial air transport sector and the identification of operational areas requiring improvement.

At the request of Mr. Alpaugh, a presentation was given to the FAA on 16 March 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.

3.2.4 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 under this JO during this reporting period.

3.2.5 Electric and Hybrid Vehicle R & D

3.2.5.1 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: The R & D Coordinating Committee met on 24 April, at which time program goals were discussed as well as public awareness plans. Aerospace supported this meeting.

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 program description section of the Level II Plan has been virtually completed. A few isolated areas remain. Work is now beginning on the goals and objectives section of the document. It is still planned to deliver a draft of the plan to DOE by the end of May. This draft will be more of a strawman than a finished document, particularly in view of the developing nature of the goals.

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: The current draft Level I Program Plan is being rewritten by Lawrence Livermore Laboratory in the form of an Energy Supply Acquisition Program Plan (ESAPP). A set of overall program goals is being drafted. The Level II goals must mesh with these new goals. Work on these revised R & D goals is in process. A meeting between DOE, Aerospace, and NASA/Lewis personnel was held on 30 April to begin formulation of specific performance-related goals. This will be followed up by discussions with Lawrence Livermore and Purdue University in early May.

4. Public Awareness and Information Dissemination Activities

Objective: To assist the EHV R & D Program in their technical information dissemination activities.

Status: The firm of Warren Weil Associates has been put on subcontract to Aerospace to assist in the information dissemination activities. In addition, negotiations are in process to subcontract with the firm of Audio Visual Specialties to assist in the preparation of visual materials. A great deal of planning and subsequent implementation effort is being carried out in preparation for a press briefing by DOE on the 2 x 4 Vehicle delivery on 14 May. Aerospace is coordinating the preparation of materials for the briefing and the briefing itself. Work has begun on a similar press briefing for the GE/Chrysler Near Term EV on 22 June.

5. Miscellaneous Support Activities

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

Status: No other activities in this area.

3.2.5.2 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: Three unsolicited proposals were given technical evaluation by Aerospace personnel during this period. These proposals resulted from the Planning Grant Program.

Five responses to Congressional and public inquiries were prepared during the reporting 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: Chrysler Corporation personnel were given the CAFE briefing on 25 April. They supplied several helpful and pertinent comments. No response has yet been received from Ford. Follow-up efforts will be initiated in May.

3.2.5.3 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 interested and participating organizations regarding comments on the existing performance standards. The general groups or types of contacts made include the following.

1. EHV Industries
2. Demonstration site operators
3. DOE contracted agencies
4. Universities, government agencies, and battery manufacturers
5. General vehicle manufacturing industry

The total of companies or organizations that have been contacted has increased to over forty. Work also continues on the generation of the list of potential recommended performance standard changes which will become part of the DOE report.

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 tcchnical nature were encountered during this reporting period.

6. PLANNED ACTIVITIES FOR MAY 1979

The month of May 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 $851,000.

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	Actual Expe... Th... 4/...
	HEAT ENGINE SYSTEMS		(34,900)	(98,600)	(143,900)	(173,500)	(205,000)	(243,700)	(287,800)	(324,100)	(371,700)	(420,500)
7751	Automotive Technology Assessment		2,100	3,000	17,900	29,400	33,900	45,100	50,200	56,600	57,400	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	71,400
7753	Highway Systems Analysis Support	$900K	20,100	76,100	97,400	106,000	122,500	143,400	177,900	199,800	236,700	277,100
7754	Evaluation of Specific Engines/Systems		0	0	4,300	9,600	14,000	14,000	14,000	14,600	14,600	14,600
7755	Special Heat Engine System Studies		0	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)	(189,700)
7756	Distillery Impact Study		5,200	8,200	9,200	9,400	11,700	15,200	15,200	16,500	19,300	20,400
7757	Immediate Action Studies Support		0	9,600	15,100	17,900	18,000	18,100	18,100	18,300	18,800	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	37,800
7759	Alternative Fuels Analysis Support		12,500	23,400	27,600	33,200	37,500	54,000	68,600	80,300	100,500	112,200
7760	Special Alternative Fuels Studies		0	0	0	0	400	400	500	500	500	500
	NONHIGHWAY SYSTEMS		(10,500)	(13,100)	(17,300	(18,300)	(21,000)	(29,800)	(37,900)	(45,900)	(55,800)	(62,800)
7761	Commercial Aviation Fuel Economy		10,500	13,100	16,200	16,900	19,600	28,400	36,500	44,500	54,400	61,400
7762	General Aviation Fuel Economy	$220K	0	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	1,400
	NEW CONCEPTS EVALUATION		(2,100)	(2,900)	(4,700)	(5,100)	(8,800)	(13,100)	(13,100)	(14,200)	(15,100)	(16,400)
7764	Proposal Evaluations	$60K	2,100	2,900	4,700	5,100	8,800	13,100	13,100	14,200	15,100	16,400
	ELECTRIC & HYBRID VEHICLE R & D		(10,300)	(24,500)	(46,200	(57,900)	(72,500)	(87,300)	(100,300)	(118,700)	(139,400)	(161,500)
7765	EHV Program Coordination Support		10,300	24,500	46,200	57,900	72,300	83,300	92,600	101,500	113,300	...00
7766	Electric Vehicle Analysis Support	$570K	0	0	0	0	200	3,500	5,900	11,000	14,000	...00
7767	Hybrid Vehicle Analysis Support		0	0	0	0	0	500	1,800	6,200	12,100	...00
	TECHNOLOGY ASSESSMENT		(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
7768	Assessment and Implementation Overview	$0	0	0	0	0	0	0	0	0	0	0
	TECHNICAL PROGRAM DOCUMENTATION		(0)	(0)	(0)	(0)	(100)	(100)	(100)	(100)	(100)	(200)
7769	Program Planning and Analysis	*	0	0	0	0	100	100	100	100	100	200
7770	Management Review and Control Document		0	0	0	0	0	0	0	0	0	0
	TOTALS	$2,090	77,200	186,300	274,700	326,000	387,300	479,600	565,200	648,500	758,000	851,000

*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 1979 Expenditure	April 1979 Expenditu
	HEAT ENGINE SYSTEMS	(34,900)	(63,700)	(45,300)	(29,600)	(31,500)	(38,700)	(44,100)	(36,300)	(47,600)	(48,800)
7751	Automotive Technology Assessment	2,100	900	14,900	11,500	4,500	11,200	5,100	6,400	800	0
7752	Technical Responses to Inquiries	12,700	6,800	4,800	4,200	6,100	6,600	4,500	7,400	9,900	8,400
7753	Highway Systems Analysis Support	20,100	56,000	21,300	8,600	16,500	20,900	34,500	21,900	36,900	40,400
7754	Evaluation of Specific Engines/Systems	0	0	4,300	5,300	4,400	0	0	600	0	0
7755	Special Heat Engine System Studies	0	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)	(13,800)
7756	Distillery Impact Study	5,200	3,000	1,000	200	2,300	3,500	0	1,300	2,800	1,100
7757	Immediate Action Studies Support	0	9,600	5,500	2,800	100	100	0	200	500	0
7758	Fuel Economy Improvement Potential	1,700	4,300	4,700	0	1,600	5,600	5,700	6,300	6,900	1,000
7759	Alternative Fuels Analysis Support	12,500	10,900	4,200	5,600	4,300	16,500	14,600	11,700	20,200	11,700
7760	Special Alternative Fuels Studies	0	0	0	0	400	0	100	0	0	0
	NONHIGHWAY SYSTEMS	(10,500)	(2,600)	(4,200)	(1,000)	(2,700)	(8,800)	(8,100)	(8,000)	(9,900)	(7,000)
7761	Commercial Aviation Fuel Economy	10,500	2,600	3,100	700	2,700	8,800	8,100	8,000	9,900	7,000
7762	General Aviation Fuel Economy	0	0	0	0	0	0	0	0	0	0
7763	Nonhighway Systems Analysis Support	0	0	1,100	300	0	0	0	0	0	0
	NEW CONCEPTS EVALUATION	(2,100)	(800)	(1,800)	(400)	(3,700)	(4,300)	(0)	(1,100)	(900)	(1,300)
7764	Proposal Evaluations	2,100	800	1,800	400	3,700	4,300	(0)	1,100	900	1,300
	ELECTRIC AND HYBRID VEHICLE R & D	(10,300)	(14,200)	(21,700)	(11,700)	(14,600)	(14,800)	(13,000)	(18,400)	(20,700)	(22,100)
7765	EHV Program Coordination Support	10,300	14,200	21,700	11,700	14,400	11,000	9,300	8,900	11,800	13,80
7766	Electric Vehicle Analysis Support	0	0	0	0	200	3,300	2,400	5,100	3,000	2,70
7767	Hybrid Vehicle Analysis Support	0	0	0	0	0	500	1,300	4,400	5,900	5,60
	TECHNOLOGY ASSESSMENT	(0)	(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)	(0)	(0)	(0)	(0)	(100)
7769	Program Planning and Analysis	0	0	0	0	100	0	0	0	0	100
7770	Management Review and Control Document	0	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	93,100

Figure 1. Program Schedule

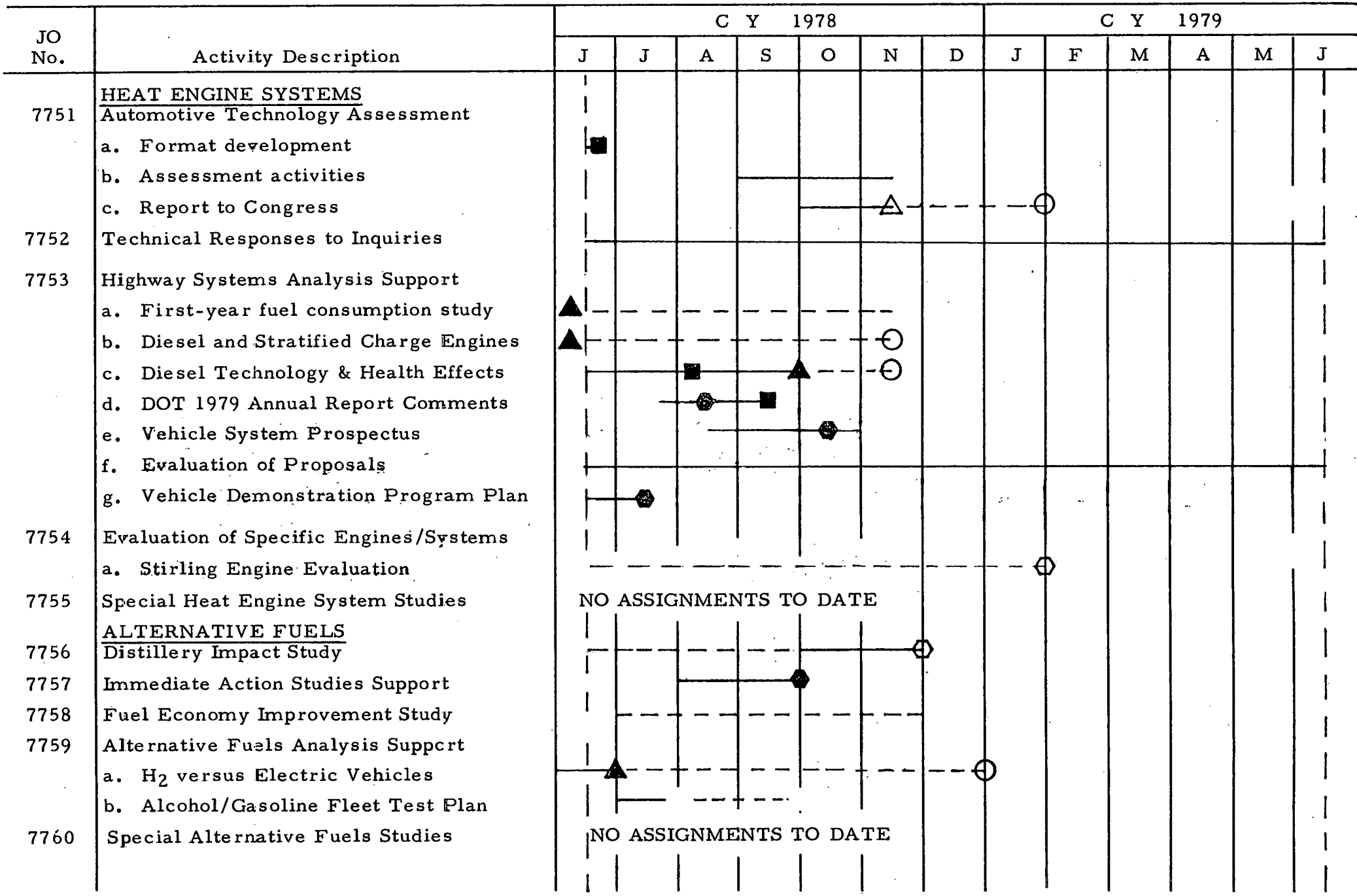


Figure 1. Program Schedule (continued)

JO No.	Activity Description	C Y 1978 J	J	A	S	O	N	D	C Y 1979 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

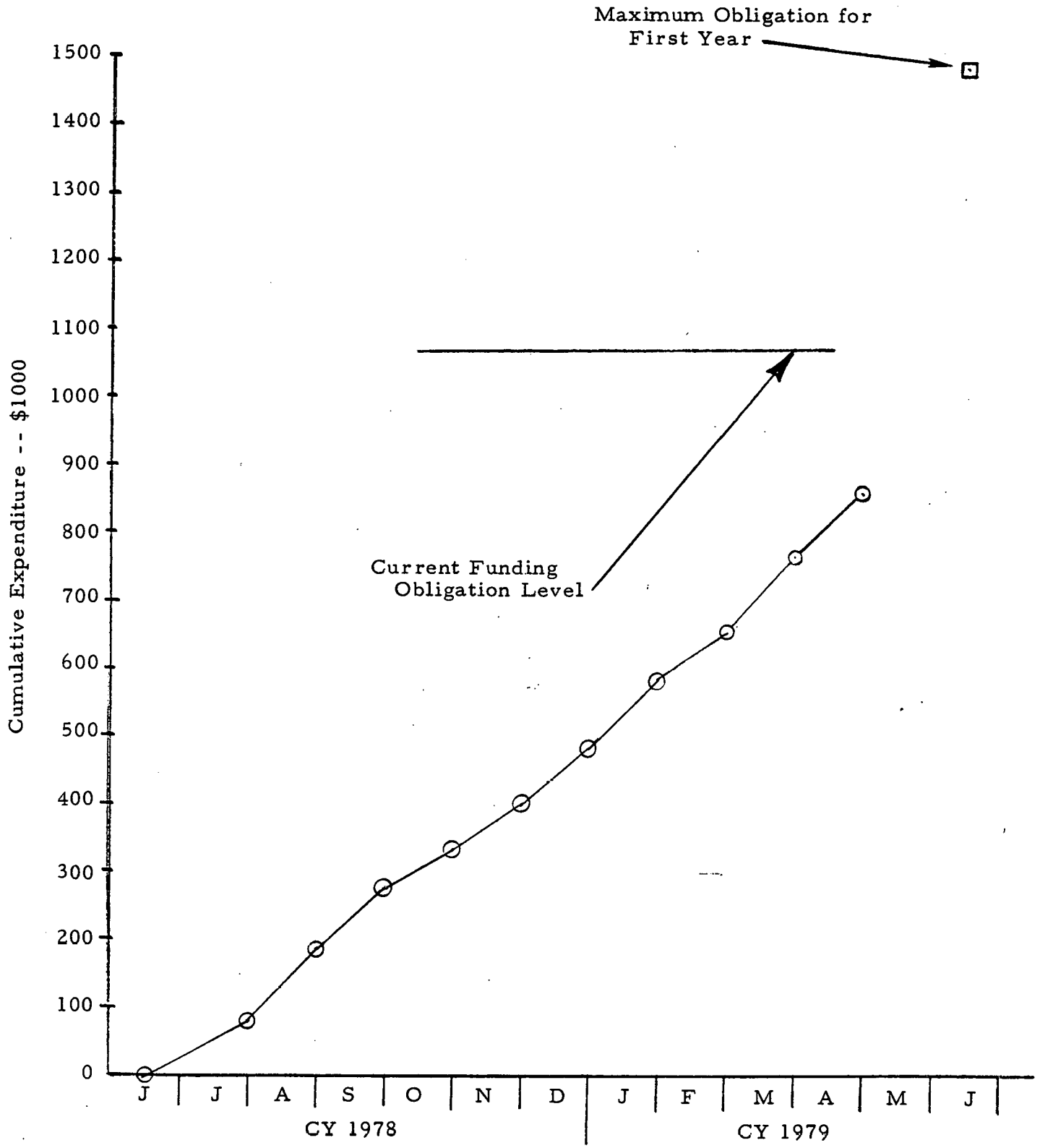
△ Rough draft of task report

⬡ 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 30 April 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)		
	22. Revised draft, "Diesel Engine Research and Development Status and Needs"	Memorandum Report, 7753.78.WUR.106, 21 September 1978	Brogan
	23. "In-vehicle Fuel Economy and Emissions Tests of the Woodworth Carburetor" -- a release of June 6, 1978 report to Mr. A. Woodworth	Letter 7753.78.WUR-98 , 5 September 1978	Esposito
	24. "In-vehicle Fuel Economy and Emissions Tests of the Woodworth Carburetor" -- a release of data for June 6, 1978 report to Mr. Jerry Cohen of Olson Co.	Letter 7753.78.WUR.99, 5 September 1978	Esposito
	25. "Comments Concerning Acceptance Criteria for Engines/ Vehicles in Demonstration Programs"	Memorandum Report, 7753.78.MGH-210, 6 October 1978	Themak
	26. "Suggested Changes to Diesel Engine Report"	Letter, 7753.78.MGH-218, 25 October 1978	Lombardi
	27. "Comments Concerning Revisions to ADTECH Prospectus, Diesel Retrofit, and Woodworth Carburetor"	Memorandum Report, 7753.78.MGH-215, 23 October 1978	Lombardi
	28. Review of Proposal, "Hydrostatic Engine," I.D. No. THP-7801211	Memorandum Report, 7753.78.WCG.32, 9 October 1978	Lombardi
	29. Review of Proposal, "Torch-Plug Stratified Charge Device," I.D. No. THP-7801186	Memorandum Report, 7753.78.RBB.04, 9 October 1978	Lombardi
	30. Rebuttal to Correspondence of Proposer of "Rationale for Stratified Charge Engine of the Three-valve Type"	Memorandum Report, 7753.78.WCG.34, 16 October 1978	Lombardi
	31. Review of Proposal, "Lessco Fuel Saving Device"	Memorandum Report, 7753.78.RRC.20, 23 October 1978	Lombardi

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
	52. Review of Proposal, "Proposed Improvements in Automotive Engines" (M. T. Leichtfuss)	Memorandum Report 7753.79.RBB.09 3 April 1979	Lombardi
	53. "Heat Engine Efficiency Comparison," text and tables	Memorandum Report 7753.79.WUR.39 4 April 1979	Brogan

Job Order Number	Description	Type of Report	Recipient at DOE/TEC
7753	Highway Systems Analysis Support (continued)		
	54. Review of Proposal, "Electronic Fuel Saver and Emission Control System" (I.D. No. THP 7900524)	Memorandum Report 7753.79.RBB.11 19 April 1979	Thur
	55. Communication with Rogers Corporation regarding Carburetor Float Analysis	Memorandum Report 7753.79.GJM.20 26 April 1979	Auger
	56. Review of Proposal, "A Proposal for Development of a Mechanically Safe, Fuel Efficient, and Environmentally Safe Internal Combustion Engine (Enclosed Turbine Engine)" (I.D. No. THP 7900617)	Memorandum Report 7753.79.RBB.12 27 April 1979	Lombardi
	57. Review of Proposal, "Research and Development Project for a High Efficiency Rankine Cycle Engine" (I.D. No. THK 90005)	Memorandum Report 7753.79.GJM.21 2 May 1979	Thur

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
	2. Report, "Combustion Efficiency of Six 1978 Model Year Spark Ignition and Diesel Engines"	Draft Report, 7758.79.GJM.14 2 April 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
	10. Review of Proposal, "Stability of Hydrocarbon Fuels" (Cohen and Cernansky)	Memorandum Report 7759.79 GJM.16 20 April 1979	Fleming

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
	9. Statements of Work for Improved Airframe Maintenance Program Tasks (for Continental Airlines and Alaska Airlines)	Memorandum Report 7761.WUR.79.41 11 April 1979	Alpaugh
	10. Plan for the Development of a Program to Monitor Airline Fuel Economy	Memorandum Report 7761.79.RRC.33 1 May 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
	2. Review of Proposal, "Development of a Basic Design of an Advanced Wind-driven Cargo Ship" (I.D. No. TNP 900288)	Memorandum Report 7763.79.JJD.09 6 April 1979	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
	8. Technical Review of Three Proposals Submitted under Planning Grant Program	Memorandum Report, 7765.RTH.79.26 27 April 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