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16. Abstract

The University of Michigan was one of eight universities selected to develop a plan for operating an UMTA Center for Transit Management Research and Training. This document is a final report of the planning work, and summarizes both the planning process and the results of that process.

While the proposed center was to be initiated with UMTA funding of $125,000 for the first year, it was concluded that a long-term program should be operated at a higher level. Educational programs resulting from this plan include augmentation of present university courses and the development and presentation of short courses for transit management personnel. Five specific research or service tasks were selected from a larger menu for implementation in the beginning year of the program. These included (1) development of instrumentation for early detection of possible vehicle failures; (2) development of field data about component failures; (3) development of analytic and computer methods for assisting in (bus) purchase decision-making; (4) continued development of traffic engineering microcomputer aids (Transit Action Performance Models or TAPM); and (5) compilation of UMTA Section 15 data into working files for further analysis.

Further detail on the background and the selected programs is available in the original planning document published in November, 1982.

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RESEARCH AND EDUCATION PROGRAM FOR TRANSIT MANAGEMENT PERSONNEL

FINAL REPORT
OF THE
PLANNING STUDY

Submitted to the

URBAN MASS TRANSPORTATION ADMINISTRATION
DEPARTMENT OF TRANSPORTATION

In Response to

Grant No. MI-06-0035

By

The University of Michigan

September, 1984

1.0 INTRODUCTION

The Urban Mass Transportation Administration developed the concept of a University Research and Training Program in 1982. The creation of University "centers" with responsibility for research, training, and service within the transit area was selected as a promising mode for utilization of multidisciplinary research experiences. In addition, it was also viewed as a means by which (1) UMTA's University Research and Training Program and Management Training Program could be more fully developed and (2) State and local agencies, including transit operators, could be included as active participants in all aspects of the center's operation.

The University of Michigan was selected as one of eight centers to be partially funded by UMTA for such a development. It was expected that each institution would seek other funding to develop the center into a viable operation. Involvement of University faculty in the research efforts, inclusion of UMTA-related material in conventional University courses, and development of special courses for transit management personnel were expected to result.

This document constitutes a final report on the planning phase of the University of Michigan's program. A major document produced as a result of this phase was the program plan,[1] a two-volume report submitted in November of 1982. While portions of that document are used in this final report, the plan contains much more detail and may be referred to in conjunction with this report.

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[1] A Plan for Research and Education Program for Transit Management Personnel, The University of Michigan, November 12, 1982

2.0 THE PLANNING PROCESS

Although several other universities had ongoing UMTA educational programs, the University of Michigan did not. There was one active UMTA-supported research program at Michigan, involving the development of microcomputer programs for transit applications of traffic engineering methods. In addition to this, several members of the University faculty had served as chairmen of the local transit authority (AATA), and others had been active in the implementation of one of the earliest dial-a-ride implementations.

The potential contributions of this University to the needs of UMTA were reviewed with faculties of five schools and colleges of the University. Present courses which were generally or specifically related to transit activity were identified. Potential research programs which would contribute to the center mission were sought, and a number of proposals presented.

During the initial planning the amount of direct UMTA funding and the potential funding from other sources was rather uncertain. Proceeding with the idea that a viable center operation should ultimately be funded at about $750,000 per year, research and service activities were defined with a total budget of this magnitude. Direct UMTA funding was ultimately set at $125,000, and the initially proposed program was modified and scaled down to fit within that budget.

2.1 Major Emphases

Partly as a result of the interests and strengths of this University, and partly because of coordination meetings with personnel from other centers, both the research and teaching programs at Michigan have centered around engineering or hardware-related problems. In particular, our previous UMTA work in traffic engineering, and faculty interest in engineering economics, electronic instrumentation, and computerized data bases, have led to the programs to be described below. The several research programs are all intended to contribute, as they mature, to the teaching/training functions of the center.

2.2 Organization

George Gamota, director of the University's Institute of Science and Technology, has been designated as the center director, with James O'Day, interim director of the Transportation Research Institute, as the project coordinator. A block diagram of the interrelationships among the major functional components of the center is shown as Figure 1.

CENTER OVERVIEW - MAJOR FUNCTIONAL COMPONENTS - INTERRELATIONSHIP

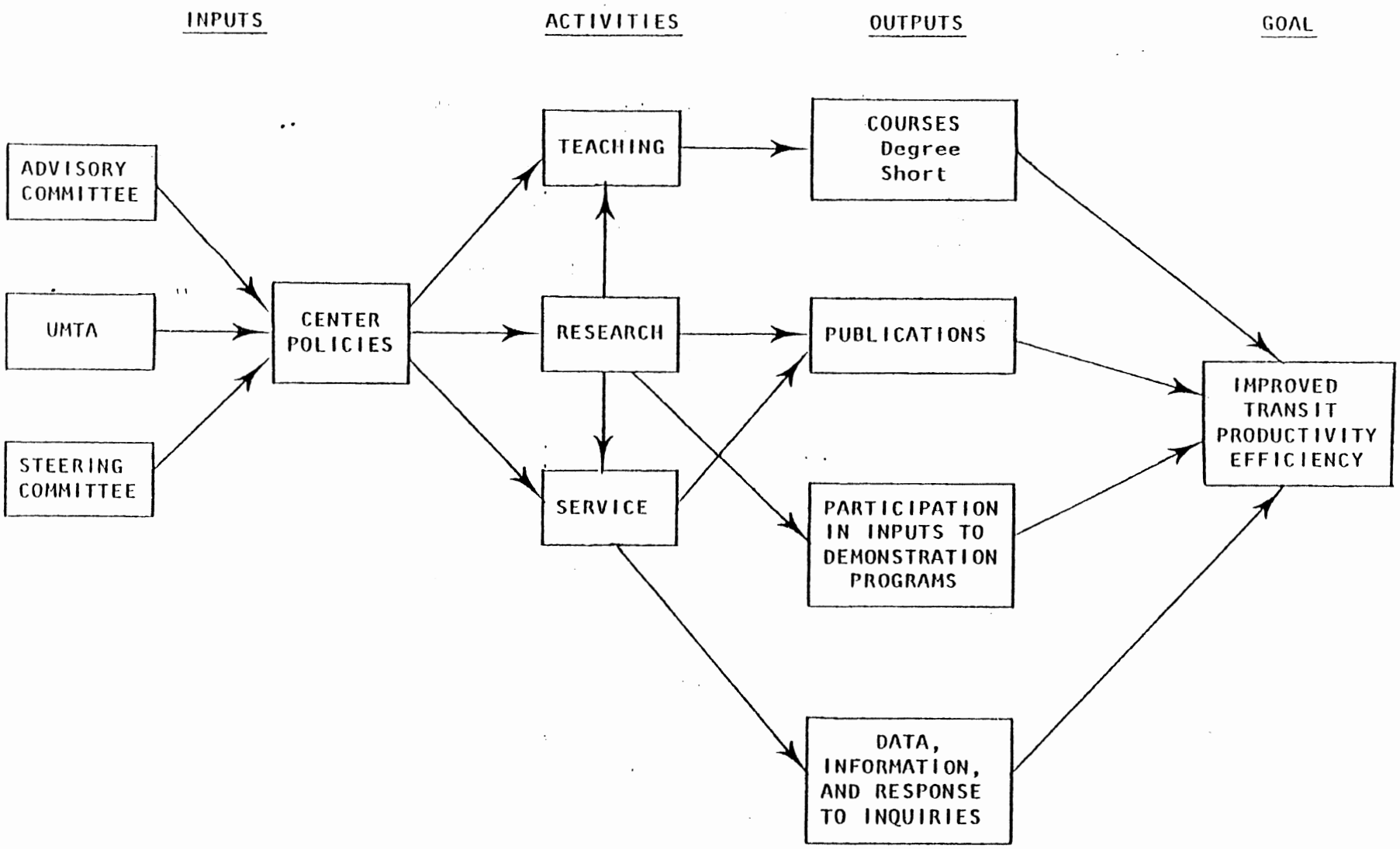

Figure 1

3.0 TEACHING ACTIVITIES

Teaching activities of the center are expected to involve present university course work which has content of general interest to the transit industry, specific new or modified courses which will concentrate mainly on transit matters, and special short courses to be developed for transit management personnel supported by Section 10 funds. In this section of the report these planned activities will be described. Further detail may be seen in Section 2 of the program plan.[2]

3.1 The University Curriculum

The University of Michigan offers a certificate in graduate transportation studies (CTS) for students seeking a graduate degree in a specialty with transportation relevance. This may include students in urban planning, civil engineering, economics, and business administration. The certificate is an endorsement in addition to the master's degree, and requires the student to take part in a broad range of interdisciplinary transportation activity.

One specific requirement of the certificate program is participation in a CTS seminar, which was in its eighth term of operation at the time that the UMTA center was being planned. Responsibility for the seminar has been rotated among various faculty members with transportation research interests. The emphasis for the seminar programs during the term in which the UMTA center operation began was the study of systems management programs available for increasing the reliability, attractiveness, and use of mass transit systems. The seminar meets weekly during the academic year, and has a principal outside speaker about once each month. The monthly meetings are widely advertised, and have attracted attendance of local transit system personnel.

In addition to the seminar, several regular University courses will serve to provide transit-related educational programs. These include

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[2] A Plan for Research and Education Program for Transit Management Personnel, Pages 5-10.

PUBLIC TRANSPORTATION SYSTEMS (Civil Engineering 574, Assistant Professor Lidia Kostyniuk), ECONOMICS OF REGULATED INDUSTRIES (Law 658, Professor Sallyanne Payton), TRANSPORTATION GEOGRAPHY (Geography 463, Professor John Nystuen), OCCUPATIONAL SAFETY MANAGEMENT, Industrial and Operations Engineering 439, Associate Professor James M. Miller), LABOR AND LEGAL ISSUES IN INDUSTRIAL ENGINEERING, Industrial and Operations Engineering 563, Associate Professor James M. Miller), EVALUATION OF SOCIAL AND ENVIRONMENTAL PROGRAMS (Natural Resources 559, Professor William D. Drake).

3.2 Continuing Education Programs

The University of Michigan had not presented short courses directed at Section 10 support in the past. Consequently we expected that the courses to be offered here would grow from the research tasks associated with the project. The first of these is expected to be an offering of a short course for transit managers to learn the essentials of traffic engineering by application of the computer models developed under UMTA Grant MI-00-63. Professors Cleveland and Kostyniuk had directed that program, and were assisted by Professor Herbert S. Levinson (of the University of Connecticut). It is expected that other courses may grow out of the work on Section 15, and the optimal equipment replacement programs (to be described later in this report).

4.0 RESEARCH TASKS

4.1 Prospective Research Tasks

Ten research projects were defined for possible support under the UMTA program. Five of these were primarily vehicle related, and the remaining five were more diverse. All of these potential tasks were discussed in the proposal, but only a few of them were ultimately funded. All ten will also be presented briefly here, and it will be noted whether they were pursued.

Two complementary tasks involved the collection of maintenance data to get an understanding of component failure experience, and the development of instrumentation methods to anticipate such failures. Professor William Ribbens, of the University's Automotive Instrumentation Laboratory, proposed to study the potential for electronic instrumentation detecting incipient failures in vehicles. This might involve, for example, the determination of engine performance in such a way as to dictate repair needs before a breakdown. The companion program called for collection of computerized maintenance data from one or more transit companies to provide candidate components for Ribbens' work. Both of these efforts were funded, although at substantially lower levels than were originally proposed.

A third program was planned to study the problems of optimal equipment replacement strategies, a program deriving from similar research being conducted in another industrial area. In the present case the work was applied to the purchase decision for new buses. This work involved several professors in the Industrial Engineering department, and was funded at a little less than half of the initially requested amount.

Two other vehicle-related programs were planned but not supported in the first-year program. These included the development of microcomputer applications for technological forecasting, and a program for analysis of the UMTA Section 15 data concentrating on vehicle-related information. The first of these had some similarity to the optimal equipment replacement study, and has been deleted from the program. The second program (analysis of the Section 15 data) was

deferred until at least the second year of the program so that the Section 15 data base could be developed first.

4.2 Non-Vehicle-Related Research Tasks

Five additional tasks were proposed. The first of these was the development of an optimal maintenance scheduling model, suitable for scheduling heavy construction equipment among several cities for maintenance or new construction work. It was judged to be peripherally related to the transit mission, and was deleted from further consideration.

A second proposed task was a graduate student seminar program to develop scenario construction methods for planning. This would have been conducted by students and members of the faculty of the University of Michigan's Urban, Technological and Environmental Planning Program (UTEP), and this would have complemented some work which had earlier been supported by a National Science Foundation grant. Although this was judged to be a potentially productive program, it could not have been accomplished at the reduced level of funding available, and it has also been deferred.

The Transit Action Performance Model (TAPM) development was initiated under a previous UMTA grant, and was nearing the stage in which the products of the work could be distributed. A program to continue the microcomputer developments, and to transform programs from Apple to IBM personal computers, was defined and supported. This program formed the basis for the first short course to be offered by the UM center.

Another proposed task was an analysis of the Section 15 data with a geographic emphasis. This would have involved a senior professor of geography, and was judged to be of potential value as a demonstration of a new use of the Section 15 data. It was deferred until at least the second year of the program because of the prerequisite to build working versions of the Section 15 data files.

4.3 Research Summary

In all, ten possible research programs were suggested as being of value in providing both direct output and background information and training for the UM faculty--the latter as preliminary to participating in transit management training activities. Within the funding available, four of the ten were supported for the first year of the program. These included:

> The study of instrumentation methods aimed at incipient failure detection.
>
> The acquisition and analysis of maintenance and failure data to complement the instrumentation study.
>
> The development of microcomputer methods for analyzing the purchase decision making process.
>
> The continuation and expansion of the Transit Action Performance Model (TAPM) computer program development.

The remaining proposed projects were deferred for the present time.

5.0 INFORMATION TRANSFER AND SERVICE ACTIVITIES

Teaching and research program have been discussed. The third kind of activity proposed for the center is in the area of service. In the proposed UM program this service has to do mainly with information transfer. Four programs were discussed in the original proposal, but only one of those has been funded, and that at a lower rate than had been anticipated. All four plans will be discussed here.

5.1 Development of a Section 15 Reporting System Data Base

The University of Michigan's Transportation Research Institute has had a major highway accident and exposure data bank in operation for nearly fifteen years. One feature of this data bank was the availability of system files for interrogation by remote users throughout the U.S. and the world. In the program plan for the UMTA center we had proposed to process the UMTA Section 15 data into a form compatible with the other files, and to make these data available to outside users. In addition, there were several uses of Section 15 data proposed (and discussed earlier in this report).

Although this task was chosen for implementation in the first year of the project, it was scaled down to develop the data files into a usable form for local operation, but not for remote users. Further development for outside use could take place in subsequent years.

5.2 Augmentation of Information Center

The University of Michigan's Transportation Research Institute Research Information and Publications Center (library) provides a specialized information service for institute staff and other members of the research community. Its collection includes more than 50,000 catalogued documents and more than 250 periodical titles covering the transportation field quite broadly. The specific strengths of the collection tend to result from the interests of the staff, and it is to be expected that the operation of a transit center will lead to an augmentation of the collection in that area.

The initial plan contained some support for this information center

operation which would have permitted more rapid development of transit materials in the library. Although not implemented as such, the UMTRI library will still serve the needs of researchers in the transit field, and the collection will be modified to be more useful to them using University funds.

5.3 A Transit Micro Center

A third proposed service activity was the development of a center for the storage and exchange of transit-related microcomputer program information. The availability of a computer networking system which is accessible from any remote points introduces the possibility of an on-line information- and program-sharing activity.

This program would have included publication of a newsletter and other means of communicating with potential users. It was not included in the final funding request because there were other UMTA-sponsored activities which served a similar purpose.

5.4 A User Outreach Program

One of the units of the University of Michigan's Institute for Social Research is the Center for Research on the Utilization of Scientific Knowledge (CRUSK). The interests of the faculty in this unit have been concerned with the methods for dissemination of technical information to ultimate users--an "outreach" program in this case.

This project would constitute an implementation based on much previous research about the method. While it would be directed by the University faculty, it would, in fact, be largely a controlled sharing of information among peers in the transit industry. UMTA has in the past sponsored research which has contributed to this methodology, and our faculty has expressed great interest in this application. This program has been deferred while other funding sources are sought.

6.0 CONCLUSIONS

The University of Michigan has welcomed the opportunities afforded by being one of the eight universities chosen to participate in the UMTA transit management research and training program. The earlier sections of this report are intended to summarize the sequence of events in the planning process, and to indicate how the final direction of the program at Michigan fits into the UMTA overall Section 11 and Section 10 activities.

This section of the report provides an opportunity to review the selection of specific programs, and to comment on their expectations.

As noted earlier in this report, it was judged during the planning process that a center should aim at an annual funding rate of the order of $750,000. It was clear that UMTA was not in a position to fund this entire amount, and that outside funding sources should be sought as soon as practicable. In beginning a new center, however, there was no history on which to base such outside requests, and the UMTA funding seemed necessary as seed money to begin programs which might later qualify for other funds.

Of the fourteen research and service tasks proposed in the original plan, five were authorized for the first year's program. These are shown in Table 1.

The original total plan had been reviewed by UMTA staff during November and December of 1982, and a general prioritization of tasks was agreed upon by UMTA and University representatives. In a January 6 letter from Professor Gamota to Ms. Meade, a revised plan was shown to include six technical tasks at an estimated $145,000. This letter, shown in the appendix to this report, defines the actual work program for the first year of the program, the sixth item (Outreach project) being deleted to bring the total budget within the $125,000 limit.

It was clear at the beginning of the first year that the original goals would have to be modified in the light of the actual budget. Nevertheless, we believed that the five tasks selected for implementation were important to the development of a center with reasonably broad capabilities.

Table 1

Summary of Selected Tasks

Short Title	Initially Proposed Funding	Final Funding	Principal Investigator
Incipient Failure Instrumentation .	$68,830	$20,000	Ribbens
Component Failure Data Collection .	$44,605	$20,000	Scott
Purchase Decision Making	$42,625	$20,000	Bean
Transit Action Performance (TAPM)	$81,845	$20,000	Cleveland
Computerization of Section 15 Data .	$52,615	$20,000	Filkins
Center Administration . .	$41,830	$25,000	Gamota
Total	$332,350	$125,000	

During the planning program some contacts were made both with management personnel in transit properties, with the state, and with manufacturers--all with the purpose of identifying other-than-UMTA support for these and subsequent tasks under the center program. No direct funding was forthcoming, probably because of the newness of the Michigan program, but solid contacts were made with all of these parties. Certainly there was strong moral support for the program, and agreements to provide service, data, or other non-monetary assistance. These contacts can be strengthened as the research and service tasks produce visible and useful outputs.

Appendix 1

INSTITUTE OF SCIENCE AND TECHNOLOGY
THE UNIVERSITY OF MICHIGAN
2200 BONISTEEL BOULEVARD
ANN ARBOR, MICHIGAN 48109

GEORGE GAMOTA
Director
(313) 764-6200

Biophysics Research Division

Great Lakes & Marine Waters Center

Highway Safety Research Institute

Industrial Development Division

Macromolecular Research Center

Merit Computer Research

Special Projects Division

January 6, 1983

Ms. Judy Meade UCC-30
Urban Mass Transportation
Administration
400 Seventh Street, S.W.
Washington, D.C. 20590

Dear Ms. Meade:

We have revieved our proposal for a Research and Education Program for Transit Management as a result of our meetings with you and representatives from the other Centers in December, and have attempted to adjust our plans to be consistent with the level of support indicated at those meetings. I believe that our continued emphasis in the hardware and vehicle-related areas will be most useful in the overall program as none of the other Centers seem to be planning for activities in that direction. The strengths of our engineering college faculty and our proximity to the producers of many of the urban transit vehicles should complement each other to further develop an expertise in this area. While the major emphasis in this Section 11 program has not been on technology, it is important to have a portion of the program so based.

As discussed at our recent meeting, we do intend to pursue the offering of a major vehicle workshop during the coming year. Plans are now in a very early stage, but I hope that we can generate a workshop with wide appeal and of national importance. I look forward to working directly with you and your staff in this endeavor. I would expect the workshop to be self-supporting, and thus it is not detailed in the budget plans presented below.

With regard to research activities, I am interested in drawing upon the University's expertise in vehicles, engines, highways, fuels, and engineering economics to lead to training materials and other products of value to the transit management profession. The research proposals discussed in our original plan have been reviewed to ascertain or consider:

(1) A minimum viable level of support for useful output.

(2) How soon the results might be available for inclusion in training courses.

(3) The potential for additional support (from other UMTA programs or sources external to UMTA) which might speed up or enhance the program.

(4) The informal evaluations of our plan which you have communicated to me and my staff.

Based on the above, I am listing those programs which we consider to be of highest priority for your consideration and comment.

1. Vehicle incipient failure instrumentation (Professor William Ribbens).

2. Accumulation and analysis of vehicle failure and breakdown information to support (1) above (Mr. Robert Scott).

3. Development of microcomputer methods for analyzing purchase decisions (Professor James Bean).

4. Extension of the TAPM (Traffic Action Performance Models) and development and presentation of a short course in this area (Professors Donald Cleveland and Lidia Kostyniuk).

5. Computerization and analysis of the Section 15 data, including some specific analyses--particularly those related to vehicles (Messrs. James O'Day and Lyle Filkins).

6. A pilot implementation of the Outreach Project for technology transfer (Professor Donald Pelz).

In addition, the program we suggested for a micro-center was based in part on a computerized conferencing technique developed for use on the University's computer. This method might be of considerable value in establishing and maintaining communications among the eight centers. Mr. O'Day has been using this system for communications among members of a TRB committee of which he is secretary, and he plans to discuss it at a meeting of center personnel during the forthcoming annual TRB meeting. The actual cost of participating in such a conference is quite proportional to usage, so that those centers which do not participate actively would incur little expense.

In discussions with the various principal investigators I have arrived at an approximate total budget of $145,000 for the six program areas cited above. I believe that this can be reduced further only by cutting one or more of the programs, and, of course, this will be the next step if required.

I hope that this information will be helpful to you in your planning. Please call Mr. O'Day (313/764-0248) or me if we can provide anything further.

Sincerely,

GG/m