August 11, 1964

Army Tank Automotive Center
Detroit Arsenal
Warren, Michigan 48090

Attention: Mr. W. Slabiak

Subject: World-Wide Survey of Automotive Transmissions and Related Drive Line Components—Progress Report for July

Dear Mr. Slabiak:

Enclosed you will find the progress report for July on the subject contract. Also enclosed are preliminary data sheets based on your notes which we discussed on July 23.

Mr. T. A. Elliott of our staff points out that the torque-speed relationship is normally expressed as a plot, and it may be unrealistic to request single numbers. In fact, I wonder whether we ought to use forms at all. I suggest that we send each manufacturer a list of desired information. This will minimize paperwork at both ends and encourage manufacturers to send literature in place of numbers.

If we do this, we could then encode for retrieval just the items of information which you anticipate are necessary. Please let me know your opinions on this.

Very truly yours,

Laurence W. Ross

Enc.

LWR/cb
Progress Report for July 1964
Contract DA-01-009-AMC-162(T)

Accomplishment:

a) Administrative. The technical staff for accomplishment of the contract has been assembled. Mr. T. A. Elliott of the Engineering Experiment Station will be technical advisor to the project in place of Mr. W. C. Boteler who is on leave. A field of interest register has been filed with the Defense Documentation Center (DDC).

b) Technical. Preliminary transmission data sheets have been drawn up and will be forwarded to the sponsor for approval. The Society of Automotive Engineers has been contacted for addresses of United States and foreign manufacturers of transmissions. Mr. L. W. Ross of the project staff visited Detroit late in the month for technical discussions with Mr. W. Slabiak of the Ordnance Tank-Automotive Command.

Problem Areas

The only problem area to date is the precise delineation of data items for inclusion on data sheets, and ultimately on data cards. This question is under consideration between the project staff and ATAC technical personnel. It is expected that a preliminary list will be adopted so that contact with manufacturers can begin not later than September.

Future Work

Project efforts for August will be hampered by vacations among most of the project staff. Work will be limited to arriving at a satisfactory set of data sheets, compiling addresses from published sources which are available, and initiating a DDC literature search.

Laurence W. Ross
Project Director
Army Tank Automotive Center  
Detroit Arsenal  
Warren, Michigan 48090

Attention: Research and Engineering Directorate

Subject: Monthly Progress Letter 2, Project A-796  
"World-wide Survey of Transmissions and Related Drive Line Components"  
Contract No. DA-01-009-AMC-162(T)  
Covering the Period from August 1 to August 31, 1964

Gentlemen:

Below you will find the summary of progress for the month of August on the subject contract.

Accomplishment

Accomplishment this month was severely limited by staff vacations and by the necessary delay involved in establishing the format for data sheets. The Defense Documentation Center announced that the ASTIA field-of-interest register for the contract had been approved. The Society of Automotive Engineers responded to contact and provided lists of members of their Transmissions Committee and related subcommittees.

Problem Areas

The principal problem area remains the establishment of data forms. This is now under consideration by ATAC technical personnel, who expect to complete their recommendations the first week in September. At that time, delineation of data items and decision on procedures for contacting manufacturers will be completed.

Future Work

When technical review is complete by the ATAC staff, the contacting of manufacturers can begin at once, before the end of September. Then the auxiliary searches in the published literature and in the DDC collection can also be launched.

Respectfully submitted,

L. W. Ross  
Project Director
Army Tank Automotive Center
Detroit Arsenal
Warren, Michigan 48090

Attention: Research and Engineering Directorate

Subject: Monthly Progress Letter 3, Project A-796
"World-wide Survey of Transmissions and Related Drive Line Components"
Contract No. DA-01-009-AMC-162(T)
Covering the Period from September 1 to September 30, 1964

Gentlemen:

Below you will find the summary of progress for the month of September on the subject contract.

Accomplishment

Establishment of data sheet formats continues to impose delay on the collection of information on transmissions and drive lines. The ATAC staff received the preliminary forms this month, and the month has been spent by their efforts to finalize these.

The present concept calls for very detailed data forms for each component - transmission, fluid coupling, converter, steer, braking system, power take off - which require the responder merely to reply with checkmarks or yes - no answers, rather than to provide elaborate data.

Problem Areas

The delay in beginning the contacting program is the principal problem area. This must wait until the data sheets are prepared in final form.

Future Work

A visit to the sponsor is planned for October. This is expected to result in agreement on the following points: (1) data sheet format, (2) general procedures for contacting manufacturers, and (3) specific procedures for contact of overseas manufacturers. Then the contacting program can begin.

Respectfully submitted,

L. W. Ross
Project Director

LWR:gh
November 2, 1964

Army Tank Automotive Center
Detroit Arsenal
Warren, Michigan 48090

Attention: Research and Engineering Directorate

Subject: Monthly Progress Letter, Project A-796
"World-wide Survey of Transmissions and Related Drive Line Components"
Contract No. DA-01-009-AMC-162(T)
Covering the Period from October 1 to October 31, 1964

Gentlemen:

The summary of progress for the month of October is presented below.

Accomplishment

The data sheet format has been developed and will be finalized early this month. The project director inspected the sample data sheets in Detroit during a visit in October, and agreed with ATAC personnel on the general features.

It was also agreed during this visit that the project staff at the Georgia Institute of Technology will develop the mailing lists, both American and foreign, and will manage the contacting program completely. Agreement was reached on general features of the letter to accompany the data forms.

Problem Areas

The data sheets remain the principal problem area. Another problem area is the lack of information on addresses of transmission manufacturers.

Future Work

The project staff will compile the initial mailing list in November. A sample letter will be drafted and inspected by ATAC personnel. The contacting program can begin when the forms, the address list, and the letter of request are complete.

Respectfully submitted,

L. W. Ross
Project Director
December 9, 1964

Army Tank Automotive Center
Detroit Arsenal
Warren, Michigan 48090

Attention: Research and Engineering Directorate

Subject: Monthly Progress Letter 5, Project A-796
"World-wide Survey of Transmissions and Related Drive Line Components"
Contract No. DA 01-009-AMC 162(T)
Covering the Period from November 1 to November 30, 1964

Gentlemen:

Progress on this contract for the month of November is summarized below.

Accomplishment

The contact of manufacturers of transmissions and drive lines was begun on a large scale. Major American automotive manufacturers were sent copies of the data forms, three pages in length, and detailed explanatory letters.

The comprehensive American Address list is in process of compilation. There has emerged a class of manufacturers of transmissions, which have to be surveyed to determine whether or not their products have vehicular applicability. This doubtful group of manufacturers is being surveyed by letter, and they will be mailed data forms in cases where their products are of interest to the project.

The National Referral Center has suggested a number of overseas organizations which may be useful contacts for foreign-made transmissions. Foreign journals have been surveyed, but foreign mailings are awaiting compilation of a complete address list.

Problem Areas

The lack of a definitive form for the data sheets is still the largest obstacle. Mailings to date have been restricted to general terms because of the delay in receiving a final specification from Detroit Arsenal.
Concerning actual operational conduct of the project, the mechanics of letter preparation imposes the most serious lag. For the production of multiple mailings, a flexowriter has been employed for the sake of verisimilitude, and this limits the rate of output.

Future Work

December will be spent in continuing the mailings to United States manufacturers, contacting overseas organizations, and completing the list of United States manufacturers, particularly the nonautomotive manufacturers. In December, the responses to mailings should begin to return, and the organization of the file of information will commence.

Respectfully submitted.

Laurence W. Ross
Project Director

LWR/ym
Army Tank Automotive Center  
Detroit Arsenal  
Warren, Michigan 48090  
Attention: Research and Engineering Directorate  
Subject: Monthly Progress Letter 6, Project A-796  
"World-wide Survey of Transmissions and Related Drive Line Components"  
Contract No. DA 01-009-AMC 162(T)  
Covering the Period from December 1 to December 31, 1964

Gentlemen:

The progress on this contract for the month of December is summarized in the following paragraphs.

Accomplishments

Major automobile manufacturers of the United States have supplied a large quantity of data to the project. Chrysler information, for example, is complete, and General Motors information is largely in hand. Borg-Warner information on transmissions is on hand, but information on associated drive lines is lacking, and the transmission information omits several data items which are of interest. Minor manufacturers of moving-vehicle transmissions have been contacted almost completely, and information is on hand from several of these.

Foreign manufacturers present a problem due to unavailability of addresses; several letters have been launched in an effort to obtain addresses, but only Sweden has returned a satisfactory list. Embassies and (where possible) local consulates are being contacted individually for names and addresses of knowledgeable sources. The British and German consulates have provided useful directories, and the German consulate has provided the address of an organization. A problem has emerged from the fact that all countries of Western Europe manufacture at least some items of interest to the project, even if they do not produce automobiles.

Truck transmissions of the United States are chiefly manufactured by transmission manufacturers rather than the truck producer; for example, Borg-Warner produced all transmissions used in Kaiser vehicles. For this reason, compilation of truck transmissions is proceeding more slowly than the automotive. Tractor and earth-moving vehicle transmissions are expected to follow the pattern of trucks, and this is the least-developed area of the project at present.

All manufacturers which have sent information have used their own published literature for the purpose. The data forms developed by the project
staff have served for purposes of illustration only. For this reason, the lack of definitive format for these forms has not seriously hindered the project, as was feared.

Problem Areas

Foreign contacts have become the most serious problem. Addresses are emerging more slowly than anticipated. Given the probability that compilation of foreign data will proceed more slowly than the American data, this delay in obtaining addresses for contact imposes a serious obstacle.

Mechanics of letter production is less of a problem this month, due to employment of an IBM Magnetic Tape Selector Typewriter to produce mass mailings. Use of standard paragraph elements for non-routine letters has prevented slowdown there.

The lack of final format for data sheets has not been a serious problem in data collection (see above), but recording of data cannot proceed until the format is established.

Future Work

January will be devoted to completing the mailings, United States and foreign. With this achieved, recording of data and design of the retrieval file can begin.

Respectfully submitted,

Laurence W. Ross
Project Director
Progress on the subject contract for the month of January is described in the following paragraphs.

**Accomplishment**

The month of January was largely given to foreign mailings. These are now well advanced, and will be finished early in February. About 500 letters have been mailed in all, U. S. and foreign.

Replies are coming in rapidly from overseas, but data is accumulating only slowly. Very little additional United States information has come in this month, after the first big rush from major manufacturers.

Contact and correspondence has now entered the stage of finishing up minor details. Some of these, however, require considerable time. Minor manufacturers also require a disproportionate effort.

**Problem Areas**

The major problem this month was the sheer volume of mailings. British and German mailings in particular were very numerous. This problem will be cleared up in February.

Another problem is logging of data. This cannot proceed until data sheet format is finalized and received by the project staff. The finalized forms have been promised for early February.

A problem is developing with the responding industries. There is clear evidence that many manufacturers are reluctant to contribute the effort involved in replying, in the absence of any immediate gain to them. It is expected that
some companies, especially the foreign, will not respond at all.

Future Work

Recording of data will begin in February as the mailing effort declines. Military transmissions will be investigated; if the U. S. Army Technical Manuals can be acquired, this data will be employed in the file. A special effort to compile data on electrical transmissions will be put under way.

Respectfully submitted,

Laurence W. Ross
Project Director

LWR:bjf
Army Tank Automotive Center  
Detroit Arsenal  
Warren, Michigan 48090

Attention: Research and Engineering Directorate

Subject: Monthly Progress Letter 8, Project A-796  
"World-wide Survey of Transmissions and Related Drive Line Components"  
Contract No. DA 01-009-AMC 162 (T)  
Covering the period from February 1 to February 28, 1965

Gentlemen:

The progress on the subject contract for the month of February is outlined below.

Accomplishment

Foreign mailings were completed this month, and a large number of replies have come in. The total number of mailings, U.S. and foreign, is now about 700. Spain is the only applicable foreign country which is not yet represented by a reply.

Major effort in February was devoted to identifying manufacturers of large earth-moving equipment. Follow-up letters to minor manufacturers also consumed much project time.

Problem Areas

The major problem area is now the Ford Motor Co. Evidently Ford is in the midst of design changes and does not wish to commit itself to availability of all its present designs. With the promise of this office that they would not be committed, Ford has promised to send at least some information to the project.

Military transmissions are another problem. There seems to be no way in which the project staff can obtain the Technical Manuals of the Armed Services on the subject of transmissions. The sponsor could possibly serve as intermediary in approving a requisition for these TM's, but months would be required. The project will probably rely on receiving this information from the separate manufacturers.
Electrical transmissions have emerged as a problem. Elaborate efforts to identify these manufacturers have all met with failure, except for a few major companies. The effort is continuing.

**Future Work**

The acquisition effort will continue in March until the returns no longer justify the work required. Recording of data, retarded so far by lack of finalization of the data forms, will begin in March. Routine filing and record keeping will consume a major portion of project time in March.

Respectfully submitted,

Laurence W. Ross
Project Director
Army Tank Automotive Center  
Detroit Arsenal  
Warren, Michigan  48090  
Attention: Research and Engineering Directorate  
Subject: Monthly Progress Letter 9, Project A-796  
"World-wide Survey of Transmissions and Related Drive Line Components"  
Contract No. DA 01-009-AMC 162 (T)  
Covering the period from March 1 to March 31, 1965

Gentlemen:

Progress on the subject contract for the month of March 1965 is summarized below.

Accomplishment

All data and literature from manufacturers have been filed in an alphabetic collection which will be turned over to the sponsor. Recording of data on forms has begun.

Some replies are still outstanding, particularly in the area of electrical drives, but the majority have probably been received. Mailings have been completed except for individual inquiries concerning points of detail.

Problem Areas

The major problem areas are manufacturers overseas who have failed to participate in the survey. These include Mitsubishi (Japan) and many of the major French manufacturers, to name the most prominent.

Problem areas of previous months, including electrical drives and Ford Motor Co., are believed to have been cleared up in March.

Future Work

In April, design of the transmission data card will be finalized. Data will continue to be recorded on 8\(\frac{1}{2}\) x 11 forms by hand, which may be completed in April. Typing of data on cards will probably not begin until May.
Much of the effort for April will be devoted to cleaning up details and organizing the material on hand.

Respectfully submitted,

Laurence W. Ross
Project Director
May 7, 1965

Army Tank Automotive Center
Detroit Arsenal
Warren, Michigan 48090

Attention: Research and Engineering Directorate

Subject: Monthly Progress Letter 10, Project A-796
"World-wide Survey of Transmissions and Related Drive Line Components"
Contract No. DA 01-009-AMC 162 (T)
Covering the period from April 1 to April 30, 1965

Gentlemen:

The progress on the subject contract for the month of April 1965 is outlined below.

Accomplishment

The month of April was spent in routine recording of information and seeking to obtain individual items of information from certain manufacturers. A design for the data card to be used in recording information was also developed and submitted to the sponsor.

Problem Areas

No new major problems developed in this period. The most serious overall problem is shortage of data from certain overseas manufacturers, which has been the subject of several attempts at remedy.

Future Work

Cards will be produced in the following month, as soon as the sponsor approves the format. It is anticipated that recording of data will be completed by the end of May and typing on cards begun.

Respectfully submitted,

Laurence W. Ross
Project Director

LWR:ph
FINAL REPORT

PROJECT A-796

WORLD-WIDE SURVEY OF TRANSMISSIONS AND RELATED DRIVE LINE COMPONENTS

L. W. ROSS

Contract No. DA-001-009-AMC-162(T)

30 June 1964 to 29 June 1965

Prepared for
Research and Engineering Directorate
Army Tank Automotive Center
Detroit Arsenal
Warren, Michigan 48090

Engineering Experiment Station
GEORGIA INSTITUTE OF TECHNOLOGY
Atlanta, Georgia
GEORGIA INSTITUTE OF TECHNOLOGY
Engineering Experiment Station
Atlanta, Georgia

FINAL REPORT
PROJECT A-796

WORLD-WIDE SURVEY OF TRANSMISSIONS AND
RELATED DRIVE LINE COMPONENTS

By
L. W. ROSS

CONTRACT NO. DA-001-009-AMC-162(T)

30 JUNE 1964 to 29 JUNE 1965

Prepared for
RESEARCH AND ENGINEERING DIRECTORATE
ARMY TANK AUTOMOTIVE CENTER
DETROIT ARSENAL
WARREN, MICHIGAN 48090
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I. INTRODUCTION

The purpose of this study has been to compile published data on transmissions now being produced which are applicable to gasoline, diesel, gas turbine, and other prime movers suitable for land vehicles. All types of transmissions are considered: mechanical, hydrokinetic, hydromechanical, hydrostatic, electrical, etc. Transmission data pertaining to systems in the range up to 1400 horsepower are included, and related drive line components including steering systems, braking systems, and power takeoffs have also been surveyed.

The method of implementing this survey has been based on direct contact with manufacturers. In order to obtain addresses of manufacturers, several sources were employed, including directories, organizations which maintain lists of manufacturers, and (in the case of foreign transmissions) embassies and boards of trade. The journal literature of the subject was surveyed but proved to be of little application to the project.

The product of the survey is a file of 5 x 8 data cards containing the data collected in the survey. Each transmission is represented by one card.
II. METHOD OF SURVEY

At the outset of the project, conventional sources of automotive product information were surveyed for manufacturers of transmissions. These sources included the Society of Automotive Engineers, Thomas' Register, and the journal literature of the subject. The National Referral Center of the Library of Congress was also contacted.

A form letter was designed for submission to manufacturers. Several variations of this standard letter had to be employed to cover the various cases of American and foreign manufacturers, depending on the circumstances of contact. A total of 1010 form letters were mailed, as well as a number of personal letters to individuals. Most of the form letters were produced on a flexowriter by means of a punched tape, but about 200 were produced on an IBM Magnetic Tape Selector Typewriter. All such letters have been accompanied by a sample data form which outlined the desired information.

Foreign manufacturers presented a problem from the beginning. The National Referral Center gave the names of several agencies abroad which could provide lists of manufacturers, but these agencies were slow to reply and were of little help. Accordingly, a procedure of telephone contact with embassies and commercial counselors of foreign countries was undertaken. Cooperation was obtained in all cases. Directories were received for manufacturers in Germany, Great Britain, Austria, Italy, and Japan, and lists were made available in the cases of Sweden, France, Belgium, Netherlands, Switzerland, and Spain. These were the only foreign countries of interest. The countries contacted which did not manufacture any automotive transmissions included Canada, Brazil, Greece, Denmark, Turkey, and Egypt.
A total of 414 companies, American and foreign, have replied. Of these, 110 have supplied data on transmissions to the project. These vary from companies who manufacture only one transmission to large companies which manufacture many models.
III. PROJECT ACCOMPLISHMENT

The number of individual transmissions in the file is 713, approximately half U.S. and half foreign.

Manufacturers overwhelmingly preferred to submit their published brochures and data sheets rather than fill out the forms. The major manufacturers were generally cooperative, with a few exceptions (see Section IV below).

The data obtained feature some interesting patterns. Some data were virtually always available; some were never available. The following comments relative to the data are appropriate.

TYPE OF TRANSMISSION: No inertia, pneumatic or hydrodynamic types were encountered. Few electric types were found. Hydrostatic types are few, and largely in the development stage.

STEERING SYSTEM DATA: Available in few cases.

BRAKING SYSTEM DATA: Available in few cases.

PTO DATA: Seldom available. Usually incomplete.

ASSOCIATED VEHICLE: This information sometimes unavailable.

OUTPUT DATA: Seldom available to desired extent.

PHYSICAL DIMENSIONS: Unavailable to surprising extent.

COST AND PRODUCTION FIGURES: Universally unavailable.

TRANSMISSION LIFE: Supplied by only one respondent.

SYSTEM INERTIA: Supplied by two respondents only.

Other items of data were supplied occasionally. The most common data items are gear ratios and input horsepower.

The survey indicated that several producers other than automobile manufacturers dominate the field of transmission manufacture: Borg Warner, Fuller Division of Eaton Mfg. Co., Dana Corp., Allison Division
of GMC, New Process Gear Division of Chrysler Corp., and Clark. In Europe, Zahnradfabrik Friedrishshaten (ZF) easily dominates the field.

The data card has been developed as the result of extended consideration by the sponsor and the contractor. Fortunately, the 5 x 8 format seems an exact fit for the items desired for inclusion, with only a few minor compromises of space. The data card format is illustrated in Figure 1.
## TRANSMISSION DATA RECORD

### GENERAL INFORMATION

- **Input Data:** Rated HP, Rated Speed, Rated Torque
- **Output Data:** Max. Torque ft-lbs., Max. Continuous Torque ft-lbs. @ Min. rpm, Max. Speed mph, Max. Continuous Speed mph
- **Conversion Mode:** Mechanical Gear, Hydro-kinetic, Hydro-mechanical, Hydrostatic, Electrical, Friction Drive
- **Pneumatic:** Combination or Other (Specify)
- **Steering Integral with Transmission:** Yes
- **Transmission Operation:** Automatic
- **Gross Vehicle Weight:** lbs.
- **Oil Filter:** Yes
- **Type of Coupling:** Friction, Hydraulic
- **Mechanical Gear Ratios (Referred to Unity):** Forward
- **Transmission Oil Capacity:** qts.
- **Engine to PTO Speed Ratios:**
- **Type of Control System (Specify):**
- **Power Take-off:** Yes
- **Brake Retarder Integral with Transmission:** Yes
- **Braking Area:** h.
- **Production per Year:**
- **Estimated Transmission Life:** hrs.
- **Availability:** Development Type, Production Type
- **Input Rotation:** Clockwise, Counterclockwise
- **Cost in Quantities:** 1, 100, 1,000, 10,000
- **Oil Cooler:** Yes
- **Oil Filter:** Yes
- **Type of Lubricants Used:**
- **Transmission Oil Capacity:** qts.
- **Other:** (Specify)
- **Vehicle Application:** Wheeled, Tracked
- **Steer Ratio in Each Range (Referred to unity):**
- **Number of Gear Steps:** Forward, Reverse
- **Power Assist Shift:** Yes
- **Brake Retarder Type:** Hydraulic
- **Min. Coolant Temp.:** °F
- **Coolant Capacity:** qts.
- **Heat Rejected to Coolant:** BTU/min.
- **Lock-out:** Yes, No
- **Ideal Coolant Temp.:** °F
- **Coolant Type:**
- **Power Transmitted Hydraulically:** %
- **Max. Coolant Temp.:** °F
- **Mode of Control:** Forward, Reverse
- **Steer Ratio in Each Range (Referred to unity):**
- **Inertia (WR):** lb.-in.²
- **Recommended Fluids:**
- **Brake Retarder Type:** Hydraulic
- **Brake Retarder Capacity:** HP
- **Estimated Life @ Max. Torque:** h.
- **Production per Year:**
- **Ambient Operating Range:** + °F to – °F
- **Vehicle Application:** Wheeled
- **Estimated Life @ Max. Torque:** h.
- **Power Transmitted Mechanically:** %
- **Number of PTO Drives:**
- **Number of Elements:** Pumps, Motors
- **Power Transmitted Hydraulically:** %
- **Max. Stall Torque Ratio:**
- **Power Assist Shift:** Yes
- **Braking Area:** h.
- **Maximum Speed:** mph
- **Rated Torque:** ft-lbs.
- **Rated Speed:** mph
- **Rated Power:** kva
- **Rated Torque:** ft-lbs.
- **Rated Speed:** rpm
- **Rated Power:** kW
- **Rated Torque:** ft-lbs.
- **Rated Speed:** rpm
- **Rated Power:** kva
- **Rated Torque:** ft-lbs.
- **Rated Speed:** rpm
- **Rated Power:** kW
- **Rated Torque:** ft-lbs.
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- **Rated Power:** kva
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- **Rated Speed:** rpm
- **Rated Power:** kW
- **Rated Torque:** ft-lbs.
- **Rated Speed:** rpm
- **Rated Power:** kva
- **Rated Torque:** ft-lbs.
- **Rated Speed:** rpm
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- **Rated Speed:** rpm
- **Rated Power:** kW
- **Rated Torque:** ft-lbs.
IV. PROBLEM AREAS

The principal difficulty encountered is the case of foreign manufacturers who refused to participate in the survey. Many foreign manufacturers were extremely generous with material, notably the German and Italian manufacturers, but at least two major countries present a general pattern of refusal to aid the project. In this way several important manufacturers have been lost to the project.

Often the foreign manufacturers would cite the lack of applicability of their transmissions to the purposes of the sponsor, for example because of integral mounting of engine and transmission. Several of these instances were followed up by letter, without result.

A few American manufacturers likewise declined to participate. One major manufacturer of automatic transmissions declined firmly even after personal contact and detailed explanation of the purpose of the project. In addition, one major automobile manufacturer contributed data only after extensive contact, and only on the express assurance that the company would not be bound by the specifications thus provided.

The general lack of details is another major problem area. It is very rare that the data on a particular transmission include more than two of the principal data items. In general, the vehicular performance of a transmission listed in the file can be reasonably anticipated on the basis of input horsepower and gear ratios, but other design criteria are largely distinguished by their absence.

Another problem area is the entire field of low horsepower transmissions, principally motorcycle transmissions. Virtually none of these are available except in integral mounts, which renders the data of doubtful value. Only the performance figures are likely to be meaningful.
V. CONCLUSIONS AND RECOMMENDATIONS

a. File Organization

The card file delivered to the sponsor is arranged in order of ascending horsepower, from front toward the back. Five general categories are indicated so that transmissions whose power and torque are unknown can be grouped in approximate order. Grouping criteria were adopted as follows:

I - Light Vehicle. 0 to 25 HP; 0 to 40 ft-lb torque.
II - Light Passenger Vehicle. 25 to 400 HP; 40 to 480 ft-lb torque.
III - Light Truck. 25 to 200 HP; 40 to 300 ft-lb torque; 4-wheel drive; 4- or 5-speed transmission; inclusion of PTO.
IV - Heavy Truck. 200 to 350 HP; 300 to 600 ft-lb torque; other features as in III.
V - Very Heavy Vehicle. Very large vehicles with performance greater than in IV.

Transmissions of unknown performance were inserted into categories according to the appropriate vehicle group. These categories apply to transmissions for wheeled vehicles and transmissions of undetermined application.

The transmissions applicable to tracked vehicles only are filed separately, according to horsepower. There are only about twenty such transmissions in the file.

b. Updating of File

The file will need updating on a regular basis in order to remain valid. The manufacturers are unlikely to submit new data without being specifically requested, so the sponsor will need to contact them individually. Another possible method is to publicize the existence
of the file, and then invite the manufacturing community to submit data voluntarily to ATAC on a continuing basis.

c. Missing Manufacturers

In the case of manufacturers, particularly foreign manufacturers, who have declined to participate in the survey, direct contact by ATAC might succeed in obtaining cooperation. Contact through the commercial counselors of the nations involved might be the most diplomatic method. Personal contact rather than mail contact will probably be required in most cases.