LEAD INDUSTRIES ASSOCIATION
60 EAST 42ND STREET
NEW YORK 17, N. Y.

November 17, 1959

TO ALL MEMBERS OF THE INDUSTRY DEVELOPMENT COMMITTEE
OF THE LEAD INDUSTRIES ASSOCIATION

Gentlemen:

Objectives of our research program are to improve our products where necessary to make them more competitive, to correct inherent defects and deficiencies, as well as to develop new products for future market exploitation. Since there is usually a considerable lag between a new development and its ultimate conversion into a profitable and salable item, it is imperative that the initial emphasis be placed upon existing products and their improvement. Wherever possible, we should also attempt to direct our new research towards markets which have the greatest potential usage. Obviously, we are interested in tonnage markets, rather than in pound markets, since the tonnage markets will, in the long run, prove most valuable and profitable in disposing of our excess production of lead.

While important sums of money should be devoted toward these existing and present products, we should by no means neglect the long-term picture, and you will note that in the past year we have attempted to balance out our over-all program so that short-term, intermediate, and long-term objectives are set forth, and research initiated in these various areas. In addition, we have not neglected fundamental research which is of vital importance to establish new thinking, new ideas, and new markets which are not in our present ken.

In the past year we have achieved several notable successes. Of these the most important is our proving-in of the Robertson continuous extrusion process for cable sheathing. This press has been brought to commercial fruition, it has produced cable sheathing on a continuous basis from all of the important alloys. It has stimulated interest in the minds of those who previously rejected the idea of lead staging a comeback for cable sheathing. This new development should certainly stem the tide of our setback in this area, and at the same time enable us to recapture sales which we had assumed were lost for good. In addition to stimulating interest in the United States, interest has spread to England and to the Continent. Not only should it enable us to produce cable sheathing on a continuous basis, it also enables us to produce it in all of the available alloys and should markedly cut production costs and improve the flexibility of the cable sheathing process since it will now enable us to use insulating materials other than paper-based dielectric materials. These factors are significant, and should, as I have mentioned before, enable us to move back into this market with a good deal of confidence.

While the potential markets are not as great, we have certainly stimulated a great deal of interest through our ceramic fellowship program. Many of these fellowships have accomplished a good deal. We have developed superior dielectric materials for various stringent electronic applications, the most notable development of the program. Many producers of ceramic materials have entered into research in these particular areas because of our own fellowship program. In addition, many of these fellowships have resulted in technical papers, bibliographies, and surveys which have enabled us to make further contact with the ceramic industry and to revitalize their interest in lead.

Thus, in 1959, we have made significant technical contributions to our industry, which will assist lead in regaining its former position and stimulate interest in areas new to lead.

In succeeding paragraphs we shall attempt to point out the important tonnage market areas where our research will be concentrated in 1960. In discussing each of the markets, we will point out the research which we have programmed to enable us to maintain our position or to capture entirely new areas in 1960.

ARCHITECTURAL MARKET

There are many areas in the architectural industry where we feel that lead can make significant new contributions as well as to regain former markets in which it held a significant position.

In 1959 we initiated our program on vibration attenuation with the lead asbestos pad and with other lead composite materials. We feel that in the coming months we shall have developed significant data which will enable us to publish a design engineering manual to enable lead to be used extensively in this architectural application as well as in other applications related to the architectural market. We have a good deal of confidence that we shall achieve success, and if our objectives are reached only in part, large tonnages of lead will be consumed. For example, there are two to three million air conditioners installed each year. If only one or two pounds of lead were used for each installation, it is obvious that thousands of tons could be used annually in this area.

In 1959 we initiated a high spot investigation of sound attentuation based on the several concrete suggestions which arose from the Skidmore, Owings & Merrill report, and in 1960 we plan to hit this area hard by not only developing fundamental data on the acoustical properties of lead, but also developing components such as partitions, panels, doorways, sliding doors, folding doors and the like, which would incorporate lead with building materials to yield sound isolating composites. With these and other components properly designed, constructed, and evaluated, we should be in a strong position to interest the architectural market in the wide application of lead for sound attenuation. We have high hopes that these developments will be the principal development of our research program in 1960, and one that will yield us large tonnage markets. We recommend this program strongly.

In the roofing field, and in related areas, lead-coated steel has for many years had a small but significant market. In our investigation of alternate methods of producing lead-coated steel, we plan to prepare pilot samples by plating, vacuum deposition, and powder cladding to evaluate the technical as well as the economic potential of these processes. We feel that the work which was initiated in 1959, and which we hope to continue in 1960, will yield us the data and economic information which should stimulate interest on the part of producers of this material if successful. There are many other research projects which we have under way whose objectives are to improve the limiting properties of lead, notably its relatively poor strength-weight ratio, and its sensitivity to creep at ambient and elevated temperatures. Our program in lead powder metallurgy is an example of an attempt to produce a higher strength lead with maximum creep resistance capable of being utilized in thinner gauges satisfactorily. This would allow lighter, more self-supporting installations, and thereby increase our competitive position. This market is only one of many for which we recommend the continuation of our powder

metallurgy program. Augmenting these programs to develop a greater market for lead in architecture, we are recommending aprogram to investigate the development and economics of composites of lead foil and sheet with paper, plastics, and similar materials to yield a lightweight composite having the patina and corrosion resistance of lead without the inherent defects of homogeneous lead sheet, notably high cost compared to other materials, excessive weight, and poor creep characteristics. These developments would be carried out in conjunction with paper and plastic producers, and it is believed that through these composites, we can produce a material more economically competitive with other architectural materials.

In addition, many of our ceramic fellowships are directly concerned with producing new architectural materials, such as leaded ceramic glazes for lightweight aggregate building blocks, porcelains for steel and aluminum partitions and curtain walls, superior glazes for whiteware bodies and other ceramic bodies.

Furthermore, we hope to initiate a program on high speed plating of lead, again directed towards coating steel and other materials with lead at a competitive price so that we can enter several markets, including the architectural market which is limited presently by the high cost of lead-coated materials produced by present methods.

There is no question that the long-term future of the architectural and building construction industry will consume very large quantities of lead. Of all the recommended programs, as mentioned before, sound and vibration attentuation are high priority projects. We feel that in these fields, in the shortest space of time, we can develop markets capable of consuming large tonnages of lead in an area where lead has few if any competitors. Once the data are developed, they must be followed by strong promotion to take advantage of the research and development accomplished.

In the following sections, the projects which have been discussed above are itemized in more detail. You will also note in many cases that these projects apply to other major markets in which their value will be reiterated in the discussions which follow.

1. Lead Asbestos Pads for Vibration Attenuation (LP-7-60) This program was initiated to develop the engineering data necessary for effective promotion of lead asbestos pads for use in building construction and machinery mounts and to evaluate other lead composite materials which may have greater vibration attenuating properties. This program has aroused a great deal of interest in this country as well as abroad. We have obtained the cooperation of other organizations in England and France, and it is believed that the combined effort will enable us to develop successful designs.

While it is contemplated that the present contract will provide us with a great deal of engineering data, it is believed that the study will lead to other designs which will need evaluation. The evaluation of each set of test pads requires an expenditure of approximately $3,000.

Because of the potentially wide range of application for lead composite pads, an additional sum of $10,000 is recommended as a contingency fund for this program in 1960.

2. Lead for Sound Attenuation (LP-16-60) Interest in lead for sound attenuation is growing at a great rate. Cooperation with manufacturers such as Cordo Chemical (with their COUSTIFAB material) as well as with organizations abroad, and the increasingly wide range of application of this type of material for sound and vibration attenuation in all types of architectural structures, lead us to believe that during the coming year we should expand our research into the design, fabrication, and test of typical structures and components for buildings of all types. For example, in the Bolt Beranek and Newman study covered under Project LP-16-59, they suggested numerous items such as acoustic curtains, acoustic panels, acoustic doors, acoustic wallpaper, ceiling tiles, and the like. The study proposed for 1960 would include the fabrication of typical structures and appropriate testing of the acoustic efficiency of these materials. It will require close coordination between suppliers of architectural products such as wallpaper, ceiling tiles, etc., to incorporate lead in these products and in turn have the composites evaluated for acoustical performance. This is rather expensive research, and it has been recommended that a sum of $30,000 be set aside to fabricate and test the appropriate structures produced. Wherever possible, cooperating manufacturers will be included to permit us to obtain maximum results from the dollars we have available for this research.

3. Production of Lead-Coated Steel (LP-26-60) It is recommended that the work on the coating of steels by vacuum metallizing, plating, etc., be continued during the coming year, and that the funds available for preparation of samples, evaluation, and testing be increased to $20,000. Because of the relatively large potential market for containers and for architectural applications, continuation is recommended. The initial results in the study of vacuum metallization of lead appear promising. Coatings have ranged in thickness from very thin to rather heavy and appear to have satisfactory adhesion. Many organizations have been approached concerning electrodeposition of lead on steel and it is expected that work will soon begin in this area.

Because of the likelihood of success and the need for establishing pilot runs of the material, either by vacuum metallizing or electroplating, adequate sums of money must be provided to put the pilot lines into operation and to produce the necessary samples to develop economic as well as engineering feasibility. Because of the excellent arrangements with the American Can Company, a portion of the evaluation program will be done for us at no charge and at the same time provide us with a critical evaluation by a large potential customer.

4. High Speed Plating of Lead - There are many areas where high speed plating of lead would be of great importance; for certain shielding applications, for the coating of metallic substrates such as the development of an effective lead-coated steel for reactors and related applications, and the architectural market. It is believed that a fundamental study of

lead electrodeposition should be carried out to develop new and improved techniques for achieving extremely high deposition rates which would make the production of lead-coated steel economically competitive to present day tin plating. A program of this nature could be carried out at a university by a post-doctorate fellow or research assistant under faculty supervision. It is recommended that $10,000 be allocated to this study.

5. Lead and Lead Composite Materials for Architectural Exteriors Certainly lead has not kept up with the growth of the building industry. The Skidmore, Owings & Merrill report indicated that our position in the building trades has fallen markedly. On the other hand, there are many areas where lead certainly can perform in a superior manner for vapor shields, flashing, roofing materials, and the like. The relatively high cost of lead, as compared to other competitive materials, has mitigated against its use. We believe, however, that a study of composite material such as a lead foil backed by waterproof paper or plastic, or metallic composites can offer us a new line of products which could be competitive. The research contemplated proposes the fabrication of these composite materials and their subsequent evaluation in structures. The monies required would permit a study of the potential applications, a study of the composite materials, the fabrication and field evaluation of typical samples. Because of the economic potential of this market it is felt that the expenditure of $20,000 is well justified for this research effort.

6. Fundamental Investigation of Lead Powder Metallurgy (LP-8-60) This program was initiated to develop the fundamental knowledge necessary to produce dispersion strengthened lead alloys by the powder metallurgy process. By this method it is believed possible to produce alloys having improved mechanical properties and resistance to creep. New alloy systems are possible through powder metallurgy which can be produced in no other manner. Although little progress has been made on the contract to date because laboratory assistance was not available until recently, it is believed to be of sufficient importance that we will want to continue the research effort for another year at a rate of $15,000.

7. Ceramic Fellowship Program - (LP-12-14-19-20-21-22-23-60) It is strongly recommended that the Ceramics Fellowship Program be continued on the same basis as in 1959. Basically the same type of subjects should be studied with the possible addition of such topics as the investigation of lead ferroelectric compounds, ceramic glazes for lightweight aggregate building blocks, and possibly a continuing review of thermoelectric type materials.

In the past year we have achieved a good deal of success through the ceramics program. Numerous papers have been issued, bibliographies have been made available and interest in the ceramic industry has been greatly stimulated. It has been recommended that the fellowship program be expanded to a total of $33,000 and be located in the maximum number of schools on topics related to the use of lead in ceramics, glasses, glazes, and ceramic type materials.

TRANSPORTATION MARKET

The transportation industry is a surprisingly large consumer of lead in bearings, alloys, solders, and batteries. For this reason, we consider this market of major importance to us, and many of our research and development projects are aimed at increasing its utilization.

One of the projects initiated in 1959 was the study of fiber- reinforced lead. These materials have large potential application. By providing a structural membrane for lead, a self-supporting, high strength, creep-resistant material is achieved. We have been surprised by the response of bearing manufacturers who consider these materials as potentially important for bearing applications. We should not neglect this development in light of this interest for bearings and other possible applications, and therefore recommend continuation of this program in 1960.

Lead as a sound attenuating material has played a very important part in the transportation industry, and it is believed it will play an increasing role in the future. As you all know, the Douglas DC-8 has utilized a lead-impregnated plastic material (COUSTIFAB) for sound attenuation in the fuselage, and other aircraft manufacturers are also users of this material. Because of increasing emphasis on sound attenuation, it is believed that the work undertaken for the architectural market will certainly play an important part in the transportation industry as well. We have not yet attempted to sell the sound isolating qualities of lead to the automotive industry; however, we certainly will go after this area once we have developed the necessary data.

Solder is widely used in the transportation industry for many applications, and we are finding increasing need for further data on lead solders. Despite the fact that solders have been in existence for many, many years, the data on fatigue and creep are lacking. To maintain our solder market as well as to expand it further, it is necessary that these data be developed.

Batteries are an important consumer of lead in present day automobiles, and may well become a more important once since the potential of the electric automobile is again increasing. It is proposed in 1960 that a project be initiated on the fundamental behavior of lead as an anode as well as a cathode in the environment of lead storage batteries. Those intimately concerned with the battery industry feel that this fundamental study would be an important contribution to the knowledge of lead in this area and help improve the efficiency of batteries. Our interest in this program will serve to maintain the interest of battery producers in the lead cell as well as provide important new data.

In 1960, therefore, we are recommending four important programs devoted to the transportation industry which we feel can make a significant contribution and help us maintain as well as expand our position in this industry.

1. Fiber Reinforced Lead - (LP-9-60) In the past year very interesting properties have been developed employing both bronze as well as steel mats to give self-supporting, high strength, creep-resistant properties to an essentially lead product. This project has stimulated a good deal of interest relative to the manufacture of self-supporting lead panels, new bearing type materials, and shielding structures. Because of the results to date, it has been recommended that this work be continued in the 1960 period at a rate of $25,000 per year.

2. Lead for Sound Attenuation (LP-16-60) (See Architectural Market, page 5, item 2).

3. Determination of Physical and Mechanical Properties Data on Lead Solders. Because of the advance of industrial technology in electronics, containers, and structural applications of all types, more and more data are required to permit adequate usage of solders. The ASTM Committee on Solders, the Lead Industries Association Solder Committee and other related organizations all agree that we are lacking in physical property and creep and fatigue data at low, room, and elevated temperatures. A minimum sum of $20,000 has been recommended to enable these data to be developed. Where possible, appropriate government agencies will be contacted to obtain maximum cooperation in this quarter. It has been stated that unless this work is carried out, the market for solders will continue to decline in favor of other materials. Therefore, to retain as well as to expand the present solder market, it is imperative that these data be developed. Solder producers and those who are well versed in the field state that continuing requests for data cannot be answered with the present information.

4. Fundamental Study of the Electrochemical Behavior of Lead in Various Media, Including Cyclic Conditions - There have been no coordinated fundamental studies carried out leading to a full understanding of the electrochemical behavior of lead, principally in the electric storage battery, and therefore an investigation of this behavior would be a major contribution to manufacturers of electric storage batteries and would give a better understanding of the electrochemistry of lead. A fundamental study possibly carried out in a university by a post-doctorate fellow or research assistant under the supervision of a faculty member to investigate the electrochemistry of lead is recommended. Such an investigation would be a very vital contribution to the knowledge of the behavior of lead in power cells, and accordingly a sum of $10,000 is recommended to pursue this work.

CONTAINER MARKET

As we are all aware, lead-coated steel has been losing out to tin-coated steel for many container applications. The manufacturers of containers have advised us that lead would regain an important place in this industry if a pore-free, controlled thickness, lead-coated steel were economically available. The inherent superior corrosion resistance of lead is desired but the economics prevent its utilization in this highly competitive industry. For example, a one-gallon can costs one to two cents more if lead-coated steel instead of tin plate is used. It is, therefore, important to develop improved coating processes for cladding steel with lead if we are to move into large potential markets. We initiated work in 1959 to evaluate lead-coating processes and recommend its continuation in 1960. Present electroplating techniques, vacuum metallization, as well as cladding by powder metallurgy, are in the process of evaluation or contemplated. In addition, the fundamental study for development of high speed electroplating processes that would be similar to and competitive with the continous electroplating lines for tin is recommended. All of these areas, we believe, should be pressed in order that we can regain our former position in this market.

1. Production of Lead-Coated Steels (LP-26-60) (See Architectural Market, page 5, item 3.

2. High Speed Plating of Lead (See Architectural Market, page 5, item 4.

MANUFACTURING EQUIPMENT AND HAND TOOLS

Our fiber-reinforced lead program can play an important part in producing new bearing materials for all types of hand tools and heavy production equipment, and therefore have an impact on this market as well as others. Furthermore, our powder metallurgy program has the capability of producing new bearing materials, also by possible combination of phases incompatible by conventional processes. Again in equipment of all types, soldering is an important joining process. However, as covered before, we are lacking in data on fatigue and creep which is minimizing the usage of solder and causing manufacturers of equipment to turn to other joining methods.

Vibration isolation is becoming important in precision equipment, manufacturing methods and equipment installation. Our work on vibration attentuation should certainly play an important part in this market and enable us to sell tonnage quantities of lead.

Thus, in this market, we are recommending four programs which have direct application to expanding the uses of lead.

1. Fiber-Reinforced Lead - (LP9-60) (See Transportation Market, page 8, item 1).

2. Fundamental Investigation of Lead Powder Metallurgy (LP-8-60) (See Architectural Market, page 6, item 6).

3. Determination of Physical and Mechanical Property Data on Lead Solders (See Transportation Market, page 6, item 3).

4. Lead Asbestos Pads for Vibration Attenuation (LP-7-60) (See Architectural Market, page 4, item 1).

ELECTRICAL AND ELECTRONICS MARKET

Several programs recommended for 1960 will serve to increase the consumption of lead in the electrical and electronic market. As covered before, our ceramic fellowship program yielded a significant lead-bearing dielectric material with performance far superior to anything produced heretofore, and this has stimulated research on the part of seven ceramics manufacturers in the dielectric field. Our ceramics program also includes work of lead ferromagnetic materials of interest to the electronics industry, and in the 1960 program a study of lead ferroelectrics is contemplated as well as a review of lead thermoelectric materials. Our fundamental investigation of the thermal and spectral emission characteristics of lead compounds may provide potential markets for lead in special electrical application to serve as light and thermal emission sources as well as high heat transfer media from electronic components.

Our research on the electrochemical behavior of lead certainly is important to this market from the standpoint of lead battery power packages. While we propose no new work in cable sheathing, our previous program in this area has certainly achieved significant results, and again points up the importance of lead in this area. The recommended solder program will serve this market also, increasing the necessity for determining the physical and mechanical data on our solders. Electronic gear is operating at higher and higher temperatures and often under stringent vibration conditions, and if we are to retain solder as a joining material, these data must be developed to insure that other joining methods are not utilized in their place. With modern engineering requirements pushing materials to the maximum of their capabilities, it is imperative that we provide the necessary data on the capabilities of our products. Unless these data are provided, the designer will not give our products the warranted consideration and we will lose out to competitive materials.

Programs relevant to this market are listed below:

1. Ceramics Fellowships (LP-12-14-19-20-21-22-23-60) (See Architectural Markets, page 6, item 7).

2. High Emission Lead Compounds (LP-11-60) This research has dealt with the efficiency of lead compounds for thermal and spectral emission.

This is a fundamental study which may have many practical applications in heat transfer components as well as in light emitting sources.

Lead telluride, selenide, oxide and sulfide are being evaluated in relation to their emission characteristics over a broad thermal and spectral radiation band. It is recommended that this program be renewed in 1960 at a cost of $4,000.

3. Fundamental Study of the Electrochemical Behavior of Lead in Various Media, Including Cyclic Conditions (See Transportation Market, page 8, item 4).

4. Determination of Physical and Mechanical Property Data on Lead Solders (See Transportation Market, page 8, item 3).

CHEMICAL MARKET

This market certainly holds a high potential for lead. Our projects are devoted to the development not only of new chemical products but also the equipment necessary for this industry. Our programs on lead-coated steel as well as on high speed plating are also directed towards producing lead-clad reactor equipment to maintain lead in this area and minimize its replacement by plastics and other metals. While we have not set aside a special program for radiation shielding, certainly it bears a close resemblance to the needs of the chemical industry for more economical methods of utilizing lead in processing equipment. Our investigation of fiber metallurgy is also a direct attempt to produce a self-supporting lead product which will correct present creep deficiencies and at the same time provide sufficient strength so that it can be a structural member as well as a corrosion-resistant lining.

The major portion of our program in this market area is devoted to the development of lead chemicals. We have three programs at present - two of a fundamental nature, and one of a very applied nature. Our over-all objective is to take existing lead chemicals or lead chemicals developed from our fundamental program and determine their applicability to potential markets such as paint finishes, insecticides, fungicides, chemical intermediates, and polymers. We feel that this is an extremely important area which may enable us to ultimately develop products which in toto will be equivalent to or surpass the lead tetraethyl market. It is quite unlikely that we shall find a single lead chemical which will have a market potential equivalent to lead tetraethyl, but the previously unexplored possibilities that exist for lead chemicals may enable us to evolve markets equivalent to it in toto.

The programs having direct impact on this large potential market are reviewed below:

1. Production of Lead-Coated Steel (LP-26-60) (See Architectural Market, page 5, item 3).

2. High Speed Plating of Lead (See Architectural Market, page 5, item 4).

3. Fiber-Reinforced Lead (LP-9-60) (See Transportation Market, page 8, item 1).

4. Lead Chemicals (LP40-60) The present program carried on by Arthur D. Little, which consists of an applied as well as a fundamental approach, has been of considerable value. In the latter months of the research effort, emphasis has been placed upon practical application of existing lead chemicals. The cooperation of the Ethyl Corporation and the National Lead Company has enabled the contractor to ascertain those lead chemicals which are readily available at a reasonable price. In turn, these products are being evaluated as insecticides, fungicides, for printing reproduction systems, chemical intermediates, and the like. Because of the broad experience and background of Arthur D. Little, it is strongly recommended that the program be continued

with emphasis again on the applied approach and upon the utilization of existing or readily available lead chemicals. It is believed that the cooperation of National Lead and the Ethyl Corporation will greatly assist the contractor in carrying out this evaluation study. A sum of $36,000 will be needed to continue the project in 1960.

5. Lead Organic Compounds (LP-18-60) This research effort with T.N.O. will be initiated on or about the first of November. Initially a review of the literature will be made, supported of course by all the documents and information made available by our earlier work and by our contributing companies. This will certainly speed up the development of background information on this research and enable Dr. van der Kerk to start on the actual experimental work at a much earlier date. As was originally conceived, this will be a fundamental study to tie in closely with the Arthur D. Little work and the other work proposed for the Quartermaster Research and Engineering Command. As in all cases where we have related research, there is a full exchange of research reports of the various contractors, literature studies, and other suggestions which come from sources within and without our industry. In this way duplication of effort is minimized, stimulation of ideas is maximized, and our research dollars do not pay for duplicate effort. Since it was realized that this work would continue for some time, it is strongly urged that funds be provided for renewal in the fall of 1960, and that the sum of money be increased to $20,000 as recommended by Dr. van der Kerk in his initial discussions.

6. Organolead Chemistry (LP-28-60) This program is to be a fundamental study to include phases different from those contemplated by Dr. van der Kerk and Arthur D. Little. The value of this research at the Quartermaster and Engineering Command is that it would include workers not paid for out of Lead Industries Association funds but out of government funds. In addition, we have the possibility of compound evaluation in the Quartermaster Laboratories at Natick, Massachusetts.

Dr. Hasselstrom, head of the group at Natick, is making arrangements with several German universities to obtain a competent organometallic chemist to carry on this effort for us.

It is strongly urged that $10,000 be set aside for this program for 1960. As mentioned above, by a full exchange of reports, meetings where possible, and visits to the various laboratories, maximum coordination will be achieved to insure that our funds are spent most effectively.

CERAMICS MARKET

We have mentioned several times previously our ceramics fellowship program which has proven to be very successful. The programs have enabled us to maintain a close association with ceramics producers and have stimulated their interest due to the theses, bibliographies, and literature surveys which have been published. In addition, we have stimulated the faculties in the ceramics departments of our important universities to think in terms of lead, and we believe that in the long run this will be a very effective yet relatively inexpensive program for the results obtained.

As stated before, one fellowship at Rutgers University has stimulated seven ceramics producers to develop a high dielectric lead-bearing ceramic insulator for electronics applications. The fact that this development has been so successful will undoubtedly stimulate other research and in turn greater consumption of lead. We believe that the program in 1960 will have equivalent results and, therefore, its continuation is imperative.

Ceramics Fellowships (LF-12-14-19-20-21-22-23-60) (See Architectural Market, page 6, item 7).

PAINT MARKET

The increasing acceptance of the latex vehicle paints in industry and the potential loss of market of lead compounds in this area because of their incompatibility with latex vehicles have resulted in a strong recommendation of our Lead Pigments Committee to initiate a program to develop compatible lead pigments for water-base vehicle primer paints. It is believed that in the long term, unless this type of work is carried out, we will lose out to other primer materials. Thus this is defensive research which if not initiated will mean a loss of markets to us. The need of the automotive and appliance industry for an active pigment-water-base primer has been discussed, and success in this program could result in a sizeable market.

A further program which has been discussed previously is the study of thermal and spectral emissive lead compounds which may have application in paints for heat transfer bodies. This is a fundamental research program and we will undoubtedly not see a practical application within the immediate future; however, the long-term possibility is there, and we feel the research initiated in the past should be continued to enable us to take advantage of this market if our research proves successful.

1. Development of a Primer Paint Incorporating Lead Compounds in Water-Soluble Vehicles. Because of the possibility of lead compounds and lead pigments losing out due to the expansion of the latex type emulsions, it is strongly urged that a program be initiated immediately to undertake a study to find lead pigments compatible with these latex vehicles to meet the demands of the automotive and appliance industries for water-emulsion, anti-corrosive primers. The Pigments Committee, as well as the Lead Chemical Subcommittee, strongly urged that this program be initiated promptly. It is believed that our position as a supplier of pigments will suffer drastically unless we find materials compatible with these new systems which are showing increasing acceptance. It is suggested that a sum of $25,000 be set aside for this study to find lead pigments compatible with the new latex systems. At the present time no stable system is known, emphasizing the urgency for this research.

2. High Emission Lead Compounds (LP-11-60) (See Electric and Electronic Market, page 11, item 2).

FUNDAMENTAL RESEARCH

We are recommending for a third year our fundamental study of lead-base alloys in binary, ternary and quaternary systems. Working with high purity lead and appropriate alloying elements, we have discovered new facts that have caused us to correct many of our previous contentions on the effects of alloying elements in lead. We feel that ultimately this will enable us to design new lead alloys, to have a far better understanding of lead and its alloy systems, and in turn to stimulate research in other areas. The program has answered many questions previously unanswered, and the dividends on this research will be collected in the years to come. We highly recommend its continuation.

We hope to initiate in the immediate future fundamental studies on the effect of surface characteristics on the mechanical and chemical properties of lead. We believe these studies to be carried out at the University of Melbourne will give us a far greater understanding of lead, its dynamic as well as static behavior, so that ultimately we can improve its performance. The metallurgical fellowship also to be awarded to the University of Melbourne will be initiated soon, and we recommend the continuation of both these programs. The previously mentioned fundamental lead chemical program should be reiterated here as being a part of our over-all fundamental research effort.

Only through fundamental research will we discover new facts in new areas to lead us on to the improvement of our product, and at the same time find new areas for investigation and the development of new industrial products.

Following are the fundamental studies recommended for 1960:

1. A Study of Lead-Base Alloys (LP-4-60) The initial study of simple binary systems has progressed quite well and a large amount of valuable fundamental data are now available. Because of the high quality of the work and the previous recommendation for continuation on into the ternary phase of the program, it is proposed that the work be continued at the termination of the present program in May of 1960. At that time it will be necessary to renew the contract to continue the study of ternary, as well as quaternary alloys. These fundamental data are needed for the design of new alloy systems as well as to help explain past phenomena which have been observed but not adequately understood. Working with extremely pure lead and alloying additions, the former data have been rendered obsolete and an entirely new understanding of lead alloy systems is now possible. It is believed that for the immediate period as well as in the future this work will be of great value to the industry. A continuation at a rate of $28,500 is therefore recommended.

2. Fundamental Surface Characteristics of Lead (LP-29-60) This fellowship which covers a fundamental study of the surface characteristics of lead as it affects chemical properties is recommended for continuation in 1960. Although the research will actually not be initiated until February of 1960, the school must know early in the fall of 1960 that the fellowship will be continued, and the monies must therefore be committed at that time. Since this is fundamental research which will take a number of years to bring to any successful conclusion, this work certainly should be supported for the

second academic year at the same rate of $4,000.

3. Lead Metallurgical Fellowship (LP-31-60) This fellowship initially approved in April has not as yet been initiated although the scope and subject are being considered. The program is expected to begin in February 1960 at the beginning of the Australian academic year. Since it will be a fundamental program which will take a number of years to bring to any successful conclusion, this work certainly should be supported for the second academic year at a rate of $4,000. It will be necessary to notify the University in the fall of 1960 that we intend to extend the work, and for this reason the funds must be budgeted although expenditures will not begin until 1961.

4. Lead Organic Compounds (LP-18-60) (See Chemical Market, page 13, item 5).

5. Organolead Chemistry (LP-28-60) (See Chemical Market, page 13, item 6).

UNDESIGNATED RESEARCH FUND

Certainly during the coming year there will be program suggestions presented to us or originated within our industry which we will want to act upon without waiting for funds to be budgeted in 1961. Several program suggestions which may require funding in 1960 are specified in the subcommittee meeting minutes. At the time of the meetings the areas were not sufficiently defined to make a concrete budget recommendation. Problem areas may also arise during the year on which it is necessary to act expeditiously, and finally programs of interest may arise in which we can participate under a very advantageous arrangement if we have the necessary funds available.

To cover these eventualities and also any contingencies arising from our program, it is strongly recommended that $50,000 be set aside in an undesignated research fund. This will give us the flexibility to take advantage of opportunities arising during the year without which additional work of interest to our industry may not be initiated or may be seriously delayed.

In summation, the program we have presented is based upon the desire for improvement of existing products, expansion of the range of application of existing products, and determination of the fundamental data necessary to stimulate further new areas for research and the further development of new and improved products. The program includes short-term, intermediate, and long-term research in all the important market areas where we believe lead can conceivably be utilized.

Schrade F. Rothe

LIA-EXPANDED RESEARCH PROGRAM

The research programs recommended for 1960 by the Metallurgical, Chemical, and Electrochemical Subcommittees are listed below:

Metallurgical Research

PROGRAM	RECOMMENDED BUDGET
1. LR-8-60 - "Fundamental Investigation of Lead Powder Metallurgy	$15,000
2. LR-26-60 - "Production of Lead Coated Steel"	20,000
3. LR-4-60 - "A Study of Lead Base Alloys"	28,500
4. LR-9-60 - "Fiber Reinforced Lead"	25,000
5. LR-7-60 - "Lead Asbestos Pads for Vibration Attenuation"	10,000
6. LR-15-60 - "Lead for Sound Attenuation"	30,000
7. LR-31-60 - Lead Metallurgical Fellowship at the University of Melbourne	4,000
8. "Lead and Lead Composite Materials for Architectural Exteriors"	20,000
9. "Determination of Physical and Mechanical Property Data on Common Lead Solders"	20,000
TOTAL	$172,500

Chemical Research

1. LR-10-60 - "Lead Chemicals"	36,000
2. LR-11-60 - "High Emission Lead Compounds"	4,000
3. Continuation of Ceramic Fellowships	24,100
4. LR-18-60 - "Lead Organic Compounds"	20,000
5. LR-28-60 - "Organolead Chemistry"	10,000
6. "Investigation of Lead Ferroelectric Compounds" Ceramic Fellowship	3,000
7. "Ceramic Glazes for Light Weight Aggregate Building Blocks" - Ceramic Fellowship	3,000
8. Undesignated Ceramic Fellowship Fund	3,000
9. "Development of a Primer Paint Incorporating Lead Compounds and Water Soluble Vehicles"	25,000
TOTAL	$128,100

Electrochemical Research

1. "Fundamental Surface Characteristics of Lead"	4,000
2. "Fundamental Study of the Electrochemical Behavior of Lead in Various Media Including Cyclic Conditions"	10,000
3. High Speed Plating of Lead"	10,000
TOTAL	$24,000

UNDESIGNATED RESEARCH FUND

It is recommended that $50,000 be set aside for undesignated research. $50,000

LEAD RESEARCH - TOTAL

Metallurgical Research	172,500
Chemical Research	128,100
Electrochemical Research	24,000
Undesignated Research Fund	50,000
TOTAL	$374,600