FEASIBILITY STUDY OF AUTOMATIC FABRICATION OF SPECTACLE LENSES IN THE FIELD

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13 ABSTRACT

The review of the state-of-the-art concerned lens fabrication techniques, materials applicable to automatic lens fabrication, and automated fabrication techniques. Over 500 suppliers of plastic materials and other products, optical and opthalmic products, automated optical equipment, and automated plastic fabricating equipment were contacted by letter. Follow-up letters were sent when items of extreme interest were uncovered or when no reply was forthcoming. A number of these suppliers were visited personally by either the Life Systems Research Institute or Univis representatives. A literature survey was begun, searching for articles related to plastic lenses, opthalmic and optical techniques and products, automated lens fabrication techniques, and plastic automated fabrication techniques. A preliminary evaluation of the material was begun. Preliminary analysis of Army field operations related to optical laboratories was initiated as well as the definition of requirements for the combat soldier. In addition, analysis of existing lens and spectacle manufacturing technology, both for plastic and glass opthalmic lenses, was also started.

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LOS ANGELES, CALIFORNIA

AND

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FORT LAUDERDALE, FLORIDA

AUGUST 1969

T. C.

FOREWORD

This is the first informal quarterly report for a Feasibility Study of Automatic Fabrication of Spectacle Lenses in the Field submitted by Life Systems Research Institute and Univis, Incorporated to the U. S. Army Medical Research and Development Command in accordance with Item E. (1) of Contract DADA17-69-C-9062, 14 April 1969.

The work was performed during the period 14 April to 13 July 1969 at the Life Systems Research Institute offices in Los Angeles, the Univis research and development laboratories in Fort Lauderdale, and the Univis Applied Plastics Division in New York. Dr. J. T. Celentano is Principal Investigator and Project Manager for the study. Mr. M. O. Rudd is Principal Investigator for Univis and Mr. M. Greshes is Associate Principal Investigator for the Applied Plastics Division of Univis.

This report was prepared by Dr. J. T. Celentano.

ABSTRACT

This report is the first informal quarterly report of a Feasibility Study of Automatic Fabrication of Spectacle Lenses in the Field, U. S. Army Medical Research and Development Command Contract DADA17-69-C-9062, 14 April 1969.

The work accomplished during the period 14 April through 13 July 1969 was in accordance with Task 1.0 Review State-of-the-Art and Task 2.0 Systems Analysis of the Schedule of Work.

The review of the state-of-the-art concerned lens fabrication techniques, materials applicable to automatic lens fabrication, and automated fabrication techniques. Over 500 suppliers of plastic materials and other products, optical and opthalmic products, automated optical equipment, and automated plastic fabricating equipment were contacted by letter. Follow-up letters were sent when items of extreme interest were uncovered or when no reply was forthcoming. A number of these suppliers were visited personally by either the Life Systems Research Institute or Univis representatives. A literature survey was begun, searching for articles related to plastic lenses, opthalmic and optical techniques and products, automated lens fabrication techniques, and plastic automated fabrication techniques. A preliminary evaluation of the material was begun. Preliminary analysis of Army field operations related to optical laboratories was initiated as well as the definition of requirements for the combat soldier. In addition, analysis of existing lens and spectacle manufacturing technology, both for plastic and glass opthalmic lenses, was also started.

CONTENTS

INTRODUCTION

This is the first informal quarterly report of a Feasibility Study of Automatic Fabrication of Spectacle Lenses in the Field. The work during this period of time was primarily devoted to Task 1.0 Review State-of-the-Art and Task 2.0 Systems Analysis.

These progress reports are provided primarily to indicate the nature of the effort expended during the particular quarter reported upon. They are primarily administrative in nature. According to the proposed schedule of work there will be a major technical report prepared and submitted at the end of each task as well as the final report.

As the title of the project implies, this is a feasibility study devoted to the determination of the capability of existing engineering technology to provide a device or system which will automatically fabricate spectacle lenses in the field. The purpose of the project is not only to determine if such a development is feasible but, if feasible, to develop the preliminary design.

As with any highly specialized technical field, the initial impulse is to jump into the middle of engineering design. This has been diligently resisted as it is recognized that the key to a successful and detailed feasibility study will be the initial surveys and analyses accomplished prior to an in-depth consideration of any one design. The rationale being that proven processes and technologies may already exist that can provide in a most cost-effective manner the desired system. New developments may also be occurring in the vast resources of industrial technology that may provide the most optimal solution; which developments would be missed without an adequate survey of the industry. In addition, resources for research and development into specific areas can most reasonably be identified.

In view of this, the first quarterly progress report is provided to indicate, briefly, the accomplishments of the first quarter, some of the problems encountered, and the direction that the project will take during the ensuing quarter.

TECHNICAL MEETINGS

A preliminary meeting was held at the Medical R&D Command on 22 April 1969. Those in attendance were: Col. J. P. McCaffrey, Director - Development Directorate; Mr. J. R. Beall, Chief - Biomedical Division; Col. M. T. Guibor, Chief - Purchasing and Contracting Office; Mrs. J. V. Egan, Contract Administrator; Col. B. Appleton, MC, Technical Advisor; Col. B. C. Green, Technical Advisor; Mr. M. O. Rudd and Mr. M. Greshes of Univis, Inc.; and Dr. J. T. Celentano of Life Systems Research Institute. The purposes of this meeting were to assure early guidance and agreement as to the technical approach, and to assist in making decisions regarding policy.

A number of characteristics regarding design criteria for the lens fabrication system were discussed. In general, it was the consensus that the feasibility study should begin with very broad criteria so as not to limit too early design concepts. It was recognized that as a result of the study preliminary design criteria might be considerably narrowed depending upon existing technology and the limitations thereof. The characteristics discussed and some of the comments in the form of guidelines are enumerated in what follows:

1. Protection. Protection is of great concern to military opthalmologists and in fact it is the opinion of many that all combat troops should wear protective glasses whether in need of correction or not.

2. Weight. The weight of the spectacles should be as light as possible. This, of course, is one of the advantages of plastic materials.

3. Scratch-Resistance. The spectacles should be as scratch-resistant as possible. This is recognized as one of the great drawbacks of plastic for opthalmic lenses.

4. Style. Wearer acceptability is an important consideration. If the automatic lens fabrication system is applicable only to the combat zone, this may not be as much of a problem as if a universal system is developed. It is important to determine the effect upon feasibility of providing a variety of styles of lenses and frames.

5. Prescription Exactness. Classical optometric requirements demand prescriptions to be within ± 1/8 Diopter, i.e., fit to within 1/4 Diopter. One of the criteria to be examined in depth as part of the feasibility study will be the actual prescription tolerance requirement for the soldier. For example, it may be desirable and practical to provide prescriptions to ± 1/4 Diopter, thus requiring only 1/2 Diopter steps. In addition, the tolerances required by the soldier in a combat zone should be determined versus the tolerances required by the Army population at large. If each lens were considered to be a crossed cylinder with the widest tolerance of ± 1/2 Diopter, adequate prescription coverage for the combat situation may be possible. In this case the emphasis would be on overcorrection. It is not to be construed from the above that a wider tolerance is acceptable, but that this may be one of the compromises that have to be taken.

6. Size of Automatic Lens Fabrication System. Recognizing that it is desirable to have a system that can be carried by a 1/4-ton trailer, the results of the feasibility study may show that a larger vehicle is required and 3/4-ton or 1-1/2-ton trailers should not be excluded.

7. Prescription Limits. At least for initial evaluations all vision capabilities should be considered, i.e., there should be no limit on the maximum prescription that can be provided by the automatic lens fabrication system. It is understood that this requirement may have to be narrowed due to the results of the feasibility study.

8. Skill Level. According to the requirements of the RFP, and as part of the basis for the RFP, the skill level required to operate the automatic lens fabrication system should be considerably less than that required of an optical technician.

9. Frames. It is desirable to have the frames and lenses combined in some way if possible, either through a single process of the system or an additional process after the lenses are made.

10. Shape. It was noted by the technical advisors that there are seven standard spectacle lens shapes as used in industrial applications, although in actuality there are a very large number of shapes on the civilian market today. Initially the possibility of having at least seven shapes in the automatic lens

fabrication system should be evaluated. This may be narrowed depending upon the results of the feasibility study and the particular application of the lens. For example, a spectacle to be used only in a combat area may have little requirement for cosmetic appearance as opposed to spectacles to be used universally throughout the Army.

11. Tint. Army spectacle lenses today are tinted. Army aviation lenses have G-15 tints and infantry lenses are G-33. The infantry lenses have less color and more U-V transmissions than the aviation lenses. The feasibility study should be concerned with lenses for Army aviators as well as ground combat personnel.

12. Photochemically Active Lenses. While the concept is desirable for a lens that may darken with exposure to bright light, those developed to date have a very poor return response. Photochemically active lens substances should be examined looking for new developments in the field.

TASK 1.0 REVIEW STATE-OF-THE-ART

With the initiation of the contract, the review of the state-of-the-art was begun and continued through the first quarter. Initially, the review consisted of extending the literature search from seventy review articles identified during the proposal. The procedure that has been developed involves a number of steps. An evaluation of a large number of abstract indexes were conducted and five were selected for in-depth survey. They are the Engineering Index, the Index Medicus, the Index of Science and Technology, Plastic Abstracts, and Reader's Guide to Periodical Literature. These indexes are then searched for key categories such as spectacles, spectacle lenses, lenses, optics, opthalmics, plastic lenses, automatic processes, lens processes, etc. Reprints of articles whose abstracts appear appropriate are secured. Each article is then thoroughly evaluated and appropriate material summarized for the survey report. In addition, the references or bibliography of each article is reviewed for leads to other articles not picked up in the index search. Additionally, a complete search of the U. S. Patents is being conducted. By the end of the quarter approximately 40 percent of the search was completed. Appendix I is a list of additional references.

In order to evaluate the state-of-the-art of the opthalmic and plastics industry a list of suppliers and manufacturers of plastic and opthalmic materials and processes was compiled. This list, provided as Appendix II, consists of 507 companies. The major opthalmic suppliers are readily identifiable and did not represent a problem. However, the plastics industry is another matter. There are over a thousand suppliers of products in this area. Fortunately, there is some degree of categorization among these industries and the following criteria were established as a basis for determining which companies ought to be contacted:

1. Companies manufacturing resins, molding compounds and other plastic materials were identified, specifically those whose products include basic resins, casting resins or compounds, laminated resins or compounds, and molding or extruding compounds--companies whose only products are organosols and plastisols, fine powders, solutions and emulsions, and electrical specialty compounds were not included.

2. Foam plastics were not included because of their non-transparent properties.

3. Companies specializing in modifiers and additives were searched for those producing stabilizers or ultraviolet absorbers.

4. Film and sheeting manufacturers and those making fabrics, papers, and fillers only were not included because these products are not applicable to optical use; however, by and large, the major companies in this area are also specialized in resins and other basic plastics.

5. Manufacturers and suppliers of laminates and reinforced plastics only were not included as these also are not applicable to optical use.

6. Those companies involved in plastics machinery or equipment whose products include injection molding machines, molds and dies, compression molds, thermoforming systems, thermoset molding machines, and those manufacturing optical instruments were identified.

7. Companies specializing in dip-coating processes were included.

8. From an initial review of plastic properties the plastics of interest were narrowed to the following and companies producing these were included--acrylic, allyl resins and monomers, cellulosic molding compounds and sheets, cellulosics, epoxy resins, fluoroplastics, nylons, phenol-formaldehydes and phenol-furfural molding compounds, phenolic cast resins, phenoxys, polycarbonates, polyesters and alkyd resins, polyethylenes, polypropylenes, polystyrene silicones, urethanes, vinyl polymers and copolymers. All these generic plastics include one or several transparent products. The other generic plastics do not include a transparent product.

A series of basic letters were prepared for several categories of companies: plastics manufacturers who may have a product of optical quality; plastics manufacturers or processors who may have a product or technique that could be used for opthalmic lens manufacturing; automatic machine processors who may have techniques or equipment that could be used for lens manufacturing and processing; and opthalmic lens producers and processors. Sample letters are included as Appendix III. Since the leaders in plastic technology have a variety of products and processes, the contacts that were made in the categories identified provide a thorough examination of the plastics and opthalmic industries both in breadth and in depth. One of the letters, selected on the basis of each supplier's major capability, was mailed to all 507 suppliers. Through the first quarter approximately 40 percent return on the letters was received. Where no return occurred an additional letter contact was made or, in some cases, telephone contact was made. Those suppliers having especially interesting processes and techniques were requested to allow a visit by a representative of the project team.

During the latter part of the quarter preparations were made for a visit to the Applied Plastics Division of Univis, Inc. by Col. McCaffrey, Mr. Beall, Col. Appleton, and Col. Green for a demonstration of some initial concepts for rapid plastic lens fabrication.

TASK 2.0 SYSTEMS ANALYSIS

During the third month of the contract this task was initiated. During this period the primary effort was devoted to reviewing military publications bearing upon Army field operations in relation to the optical laboratory and the potential for automatic fabrication of spectacle lenses. In addition, the development of requirements for spectacles in terms of personnel needs and combat conditions was begun. The latter effort has been devoted to a realistic determination of the actual needs of the soldier for prescription accuracy, especially the combat soldier. For example, the current optical laboratory carries over 700 different prescription types. If, as has been suggested, a tolerance of $\pm$ 1/4 Diopter is used, the total number of prescription requirements will be markedly reduced. In addition, if the extreme prescriptions are eliminated on the basis of the probability of these being required, the prescription numbers can further be reduced. This is not to intimate that the automatic lens fabrication system will not ultimately be designed for all conceivable prescriptions, but that the ensuing trade-offs may show that by delimiting prescription requirements a much more sophisticated end-product may be practicable in the early stage of development.

During the first quarter the technology analysis was begun in two areas. First, the analysis of existing glass lens processing techniques has been examined in great detail. Some of this material will be presented as part of the survey of the state-of-the-art. Secondly, some approaches to plastic lens fabrication are being evaluated in great depth. New information being identified and evaluated indicate that probably the least part of the problem will be materials. Rather, the automated technique and mold requirements will be the most significant problems to be solved.

PROBLEMS AND PLANS

The major problem experienced during this quarter has been the slowness of the response of the suppliers to initial and secondary contacts. In many instances it has been necessary to follow-up with a telephone contact. Suppliers of whom a visit request was made have also been slow in responding, although visits are now averaging two or more a week. Because the lag time is primarily due to the response of the suppliers, it served no purpose to have additional personnel working simultaneously on this task. It is more important to more effectively complete this task by conserving effort during the early portion so that more senior personnel can evaluate the results of the survey. To this end, then, it is necessary to extend completion of Task 1.0 by one month. It is not anticipated that this will have any effect on the performance, cost, or overall schedule of the project.

On the basis of the survey to date it appears that materials may not be the problem, with one exception. While thermal plastic materials have not undergone great technical growth in the past five years, there has been considerable technical development of thermosetting materials. These now appear to show the greatest promise for desirable qualities and fast processing. The problem of abrasion resistance is still, however, a significant problem and it may well be that some form of coating will be required.

Possibly the most pressing problem will be that of automatic processing and multiple mold requirements versus lightweight and speed. This is being examined in great detail and solutions sought prior to preliminary design initiation.

During the second quarter the survey is to be completed as well as the system analysis. In addition, the Task 3.0 Preliminary Design will be initiated. A large number of visits to manufacturers and suppliers having processes and techniques of interest will be made during the early part of the second quarter.

COST AND SCHEDULE

During the proposal and initial contract period the effort to be expended was planned by task. Since that time re-evaluation of the effort distribution has been made, primarily with respect to the amount of time that would be devoted to the project by senior personnel.

In accordance with discussions with Col. J. P. McCaffrey, Col. M. T. Guibor, and Mrs. J. V. Egan, Task 4.0 Cost Effectiveness Evaluation will be considerably reduced in effort and scope and the difference applied to other tasks.

As mentioned earlier the costs incurred to date have been somewhat below the average anticipated due to the smaller effort on Task 1.0 Review State-of-the-Art during the first two months. The rate will, however, increase and actual costs will approach the planned costs during the second and third quarters. Figure 1 shows the accumulated actual costs and the estimated costs.

As discussed in the preceding section, it is necessary to extend the completion of Task 1 by one month. An updated schedule is presented in Figure 2.

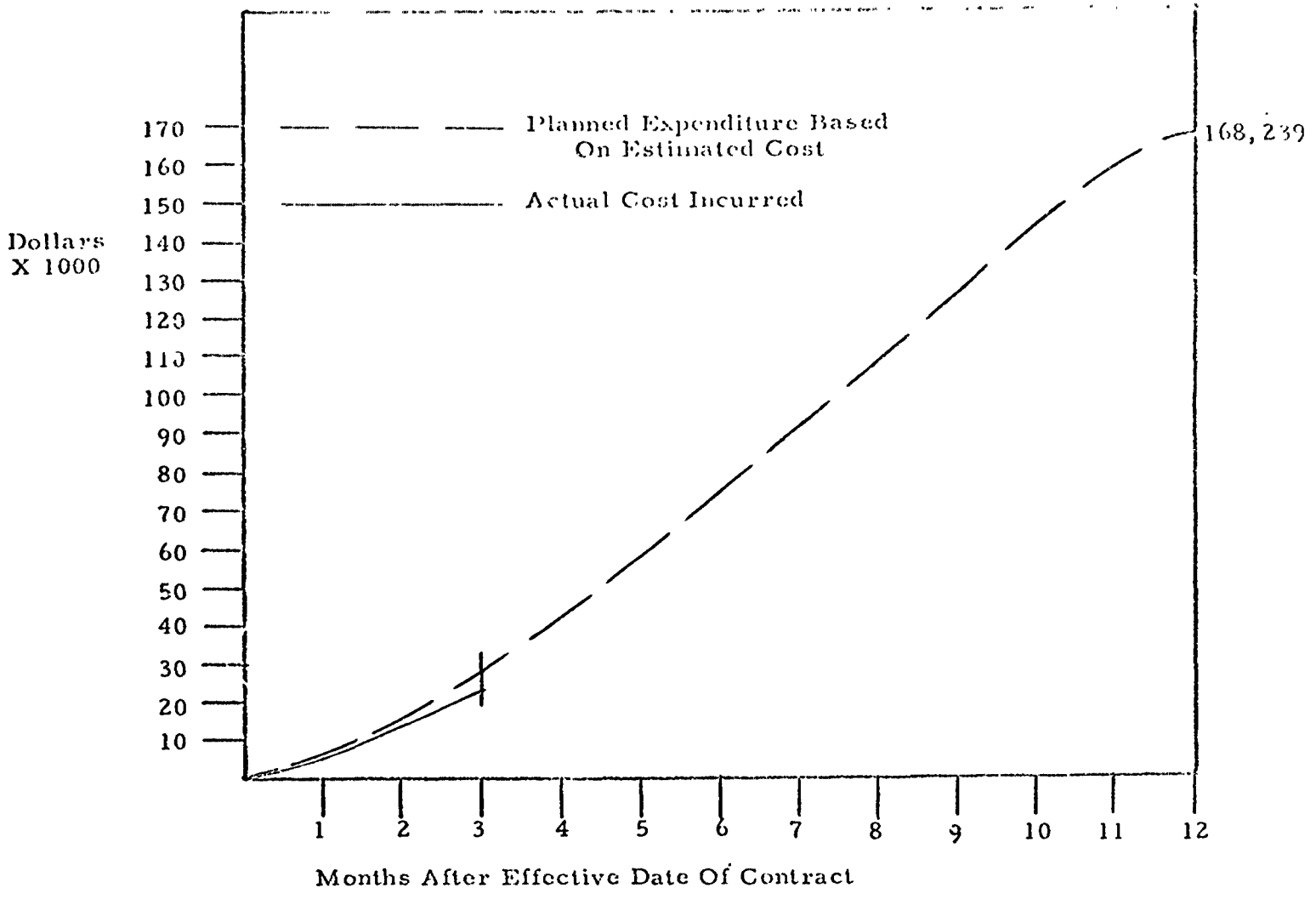

Figure 1. Project Planned And Actual Costs

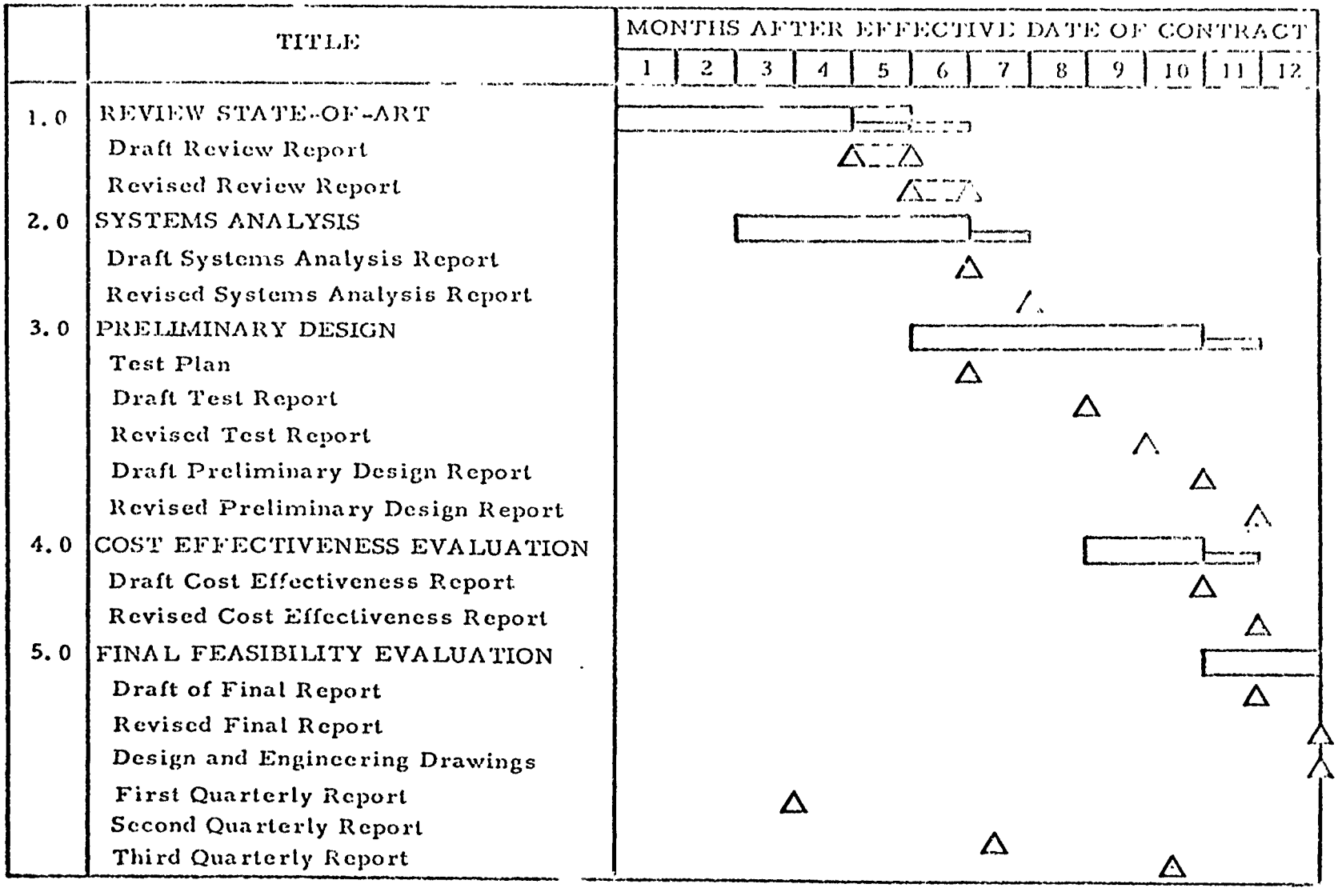

Figure 2. Project Schedule

APPENDIX I

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APPENDIX II

LIST OF SUPPLIERS AND MANUFACTURERS CONTACTED

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New York, New York 10006

Atlas Hydraulics, Inc.
3576 Ruth Street
Philadelphia, Pa. 19134

Atlas Minerals & Chemicals Div.
The Electric Storage Battery Co.
151 Ash Street
Mertztown, Pa. 19539

Atlas Plastics, Inc.
681 Seneca Street
Buffalo, New York 14210

Atlas Vac-Machine Division
Koehler-Dayton, Incorporated
401 Leo Street
Dayton, Ohio 45404

Atols Tool & Mold Corporation
3828 N. River Road
Schiller Park, Illinois 60176

Auburn Plastics, Incorporated
Auburn, New York 13021

Auto-Vac Company
Division of Plast-O-Craft, Inc.
391 Mulberry Street
Newark, New Jersey 07102

Avisun Corporation
21 S. Twelfth Street
Philadelphia, Pa. 19107

Axel Plastics Research
Laboratories, Incorporated
41-14 29th Street
Long Island City, New York 11101

Bacon Industries, Inc.
192 Pleasant Street
Watertown, Mass. 02172

Badische Analin & Soda Fabrik AG
67 Ludwigshafen
Rhein, Germany

Baird Dynamic Co.
Division of Searchway, Inc.
686 Bostwick Avenue
Bridgeport, Conn. 06605

Baker Brothers, Inc.
P. O. Box 101, Sta. "F"
Toledo, Ohio 43610

Baker Castor Oil Co.
40 Avenue "A"
Bayonne, New Jersey 07002

Baker, J. T., Chemical Co.
N. Broad Street
Phillipsburg, New Jersey 08865

Battenfield Corp. of America
7301 N. Monticello Avenue
Skokie, Illinois 60076

Bausch & Lomb, Incorporated
635 St. Paul Street
Rochester, New York 14602

Beacon Die-Mold, Inc.
57 Crooks Avenue
Clifton, New Jersey 07011

Bean Fiber Glass, Inc.
59 Peterboro Street
Jaffrey, New Hampshire 03452

Becker & van Heullen
Niederrheinische Maschinenfabrik
Untergath 100
Kreteld, Germany

Beckman Instruments, Inc.
2500 Harbor Boulevard
Fullerton, California 92634

Belding Chemical Industries
1407 Broadway
New York, New York 10018

Beloit Eastern Corporation
Plastic Machinery Division
Washington & Greene Streets
Downington, Pa. 19335

Benson Optical Co.
Medical Arts Building
825 Nicollet Avenue
Minneapolis, Minn. 55402

Bermer Tool & Die, Inc.
Golt Street
Southbridge, Mass. 01550

Berton Plastics, Inc.
170 Wesley Street
S. Hackensack, N. J.

Best Quality Plastics, Inc.
4305 Oneida Street
Denver, Colorado 80216

Biggs, Carl H., Co., Inc.
1547 - 14th Street
Santa Monica, Calif. 90404

Bipel International, Inc.
22 Nutmeg Drive
Trumbull, Conn. 06611

Bishop Mfg. Corporation
10 Canfield Road
Cedar Grove, N. J. 07009

Biwax Corporation
45 E. Bradrock Drive
Des Plaines, Ill. 60016

Blane Chemical Corp.
N. Main Street
Mansfield, Mass. 02048

Bondy Engineering Co.
172 S. Portland Avenue
Brooklyn, N. Y. 11217

Bontec Corporation
750 Canal Street
Stamford, Conn. 06902

Borden Chemical Co.
Division of The Borden Co.
350 Madison Avenue
New York, New York 10017

Brand Plastics Company
130 E. Randolph Drive
Chicago, Illinois 60601

British Industrial Plastics, Ltd.
Popes Lane
Oldbury, Birmingham, England

Brown Machine Co. of
Michigan, Incorporated
110 Pearson
Beaverton, Mich. 48612

Buhler Brothers
Uzwil-SG, Switzerland

Byrd Tool & Mold Corporation
2953 W. Twelfth Street
Erie, Pa. 16505

CIBA Products Company
Division of CIBA Corporation
556 Morris Avenue
Summit, New Jersey 07901

Canadian Industries, Ltd.
630 Dorchester Boulevard
W. Montreal, Que., Canada

Cardinal Chemical Company
RFD 4, P. O. Box 779
Columbia, S. C. 45239

Carlisle Chemical Works, Inc.
West Street
Reading, Ohio 45215

Carson Tool & Mold Company
431 S. Four Lane Highway
Marietta, Georgia 30062

Carver, Fred S., Inc.
5 Chatham Road
Summit, New Jersey 07901

Catalin Corporation
Division of Ashland Oil & Refining Co.
1 Park Avenue
New York, New York 10016

Celanese Coatings Company
Resins & Chemicals Division
224 E. Broadway
Louisville, Kentucky 40201

Celanese Plastics Company
550 Broad Street
Newark, New Jersey 07102

Center-Line Machinery
14772 Collins Avenue
Orange, California 92669

Central Scientific Company
1700 Irving Park Road
Chicago, Illinois 60613

Chemical Automation Corp.
29 Burbury Lane
Great Neck, N. Y. 11023

Chemical Coatins & Engineering Company
221 Brook Street
Media, Pennsylvania 19063

Chemical Development Corp.
Endicott Street
Danvers, Mass. 01923

Chemical Industries
75 N. Beacon Place
Pasadena, California 91107

Chemische Werke Huls AG
MarlKries
Recklinghausen, Germany

Chemore Corporation
100 E. 42nd Street
New York, New York 10017

Chemstrand Corporation
350 Fifth Avenue
New York, New York 10001

Chevron Chemical Company
200 Bush Street
San Francisco, Calif. 94120

Chicago Mold Engineering Co., Inc.
4141 Washington Boulevard
Hillside, Illinois 60162

Cincinnati Development & Manufacturing Company
5614 Wooster Pike
Cincinnati, Ohio 45227

Clifton Hydraulic Press Co.
293 Allwood Road
Clifton, New Jersey

Clinton Company
7701 W. 47th Street
Lyons, Illinois

Colab Resin Corporation
Main Street
Tewksbury, Mass. 01876

Collins, Caldwell & Dague, Inc.
16616 Garfield Avenue
Paramount, California 90723

Columbia Technical Corporation
24-30 Brooklyn-Queens Expressway
W. Woodside, New York 11377

Columbian Carbon Company
Plastics Division
380 Madison Avenue
New York, New York 10017

Comet Industries, Inc.
1320 N. York Road
Bensenville, Illinois 60106

Commercial Resins Division
Interplastic Corporation
2015 NE Broadway Street
Minneapolis, Minnesota 55413

Commercial Solvents Corp.
260 Madison Avenue
New York, New York 10016

Conap, Incorporated
184 E. Union Street
Allegany, New York 14706

Conneaut Rubber & Plastics Co.
U. S. Stoneware Co.
Chamberlain Boulevard
Conneaut, Ohio 44030

Consolidated Models, Inc.
P. O. Box 336
Cranbury, New Jersey 08512

Cook Paint & Varnish Co.
P. O. Box 389
Kansas City, Mo. 64141

Cosden Oil & Chemical Co.
P. O. Box 1331
Big Springs, Texas 79720

Cosmic Plastics, Inc.
12314 Gladstone Avenue
San Francisco, California

Cosmosplastics, s.r.l.
Galleria Buenos Aires 11
Milano, Italy

Covema, s.r.l.
Via Fontano 1
Milan, Italy

Coz Chemical Corp.
Providence Road
Northbridge, Mass.

Cumberland Chemical Corp.
Subsidiary of Air Reduction Co., Inc.
PVC Division
150 E. 42nd Street
New York, New York 10017

Cuming, M. A., Co.
49 Bleecker Street
New York, New York 10012

Cylke's Injection Mold Co.
Route 1, Canton Highway
Woodstock, Ga. 30188

D-M-E Corporation
6686 E. McNichols Road
Detroit, Michigan 48212

Dake Corporation
641 Robbins Road
Grand Haven, Michigan 49417

Damascus Tool Company
P. O. Box 422
Union, New Jersey 07083

Damen Tool & Engineering Co., Inc.
4621 N. Olcott Avenue
Chicago, Illinois 60656

Danley Machine Specialties, Inc.
2100 S. Laramie Avenue
Chicago, Illinois 60650

Delta Molds, Inc.
1021 Paulison Street
Clifton, New Jersey 07011

Dennis Chemical Co.
2701 Papin Street
St. Louis, Mo. 63103

Design Center, Incorporated
5-26 46th Avenue
Long Island City, New York 11101

Devcon Corporation
Endicott Street
Danvers, Massachusetts 01923

Di-Acro
Division of Houdaille Industries, Inc.
578 Eighth Avenue
Lake City, Minnesota 55041

Diamond Shamrock Company
300 Union Commerce Building
Cleveland, Ohio 44115

Diemolding Corporation
125 Basbach Street
Canastota, New York

Dolph, John C., Company
New Road
Monmouth Junction, N. J. 08852

Dow Chemical Company
Midland, Michigan 48640

Dow Corning Corporation
S. Saginaw Road
Midland, Michigan 48640

Dunning & Boschert Press Co., Inc.
329 W. Water Street
Syracuse, New York 13202

Du Pont de Nemours, E. I. & Co., Inc.
1007 Market Street
Wilmington, Delaware 19898

Durez Plastics Division
Hooker Chemical Corporation
277 Walck Road
N. Tonawanda, N. Y. 14121

Dusal Machine Division
Dusal Tool & Mold Co., Inc.
130 Finn Court
Farmingdale, N. Y. 11735

Easco-Sparcatron, Inc.
100 Morgan Road
Ann Arbor, Michigan 48104

East Coast Chemicals Co.
417 Main Street
Little Falls, New Jersey 07424

Eastman Chemical Products, Inc.
Subsidiary of Eastman Kodak Co.
Kingsport, Tenn. 37662

Efficient Industries Corporation
9314 Elizabeth Avenue
Cleveland, Ohio 44105

Electroformex Laboratories
600 Fisher Street
Franklin, Mass. 02038

Electroforms, Incorporated
239 E. Gardena Boulevard
Gardena, California

Electromold Corporation
140 Enterprise Avenue
Trenton, New Jersey 08602

Electronic Space Structures Corp.
Old Power Mill Road
E. Concord, Mass. 01781

El-Tronics, Inc.
Electronic Products Div.
11 S. Irvine Street
Warren, Pa. 16365

Emerson & Cuming, Inc.
869 Washington Street
Canton, Mass. 02021

Emery Co., Inc.
11411 Bradley Avenue
Pacoima, Calif. 91331

Enjay Chemical Company
60 W. 49th Street
New York, N. Y. 10020

Epoxy Products Co.
Division, Allied Products Corp.
119 Coit Street
Irvington, New Jersey 07111

Epoxylite Corporation
1428 N. Tyler Avenue
S. El Monte, Calif. 91733

Erie Engine & Manufacturing Co.
953 E. Twelfth Street
Erie, Pa. 16512

Erie Foundry Company
1253 W. Twelvth Street
Erie, Pa. 16512

Escambia Chemical Corp.
261 Madison Avenue
New York, New York 10016

Ethyl Corp.
100 Park Avenue
New York, New York 10017

Ethyl Corporation
Polymers Division
P. O. Box 1466
Baton Rouge, La. 70821

Euclid Engineering Co.
105 E. "A" Street
Upland, California

Excel Mold, Inc.
939 E. Troy Avenue
Indianapolis, Indiana 46203

FMC Corporation
Organic Chemicals Division
633 Third Avenue
New York, New York 10017

Fabrite Metals Corp.
205 E. 42nd Street
New York, New York 10017

Farrel Corporation
25 Main Street
Ansonia, Conn. 06401

Farrell Corporation
Plastics Molding Machinery Div.
656 Blossom Road
Rochester, New York 14610

Fellows Gear Shaper Company
78 River Street
Springfield, Vt. 05156

Fenwall, Inc.
400 Main Street
Ashland, Mass. 01721

Ferracute Machine Co.
E. Commerce St.
Bridgeton, N. J. 08302

Ferro Corporation
Cordo Division
34 Smith Street
Norwalk, Conn. 06852

Ferro Corporation
Ferro Chemical Division
7050 Krick Road
Bedford, Ohio 44014

Fiberfil, Incorporated
1701 N. Heidelbach Ave.
Evansville, Indiana 47717

Fiberite Corporation
513 W. Fourth Street
Winona, Minnesita 55987

Firestone Plastics Co.
Div. Firestone Tire & Rubber Co.
P. O. Box 699
Pottstown, Pa. 19464

Fjellman American, Inc.
105 Republic Avenue
Joliet, Illinois 60435

Flexible Products Company
P. O. Box 996
Marietta, Georgia 30060

Flexcraft Industries
527 Avenue "P"
Newark, N. J. 07105

Fluorocarbon Company
1754 S. Clementine Street
Anaheim, California 92802

Ford Motor Company
Paint & Chemical Products Plant
151 Lafayette Street
Mount Clemens, Michigan 48044

Foster Grant Company, Inc.
289 N. Main Street
Leominster, Mass. 01453

France Campbell & Darling, Inc.
Kenilworth, New Jersey 07033

Franklin Fibre-Lamitex Corp.
903 E. 13th Street
Wilmington, Delaware 19899

Freeman Chemical Corporation
Division, H. H. Robertson Co.
222 E. Main Street
Port Washington, Wisc. 53074

French Oil Mill Machinery Co.
1035 W. Greene Street
Piqua, Ohio 45356

Furane Plastics, Inc.
4516 Brazil Street
Los Angeles, California 90039

Fusecolor Corporation
270 Lincoln Boulevard
Middlesex, New Jersey 08846

Future Chemicals Group of Mfg. Cos.
2849 Montrose Avenue
Chicago, Illinois

G. B. F. Costruzioni Meccaniche S. p. a.
Via Vittorio Veneto 12, Bresso
Milano, Italy

GLUCO
P. O. Box 315
Monroeville, Pa. 15146

Garden State Chemical Co.
P. O. Box 97
Morris Plains, N. J. 07950

Gardner Laboratory, Inc.
5523 Landy Lane
Bethesda, Md. 20014

Garfield Manufacturing Co.
P. O. Box 59
Garfield, New Jersey 07026

Geigy Industrial Chemicals
Saw Mill River Road
Ardsley, New York 10502

General Aniline & Film Corp.
140 W. 51st Street
New York, N. Y. 10020

General Electric Company
Chemical Materials Dept.
1 Plastics Avenue
Pittsfield, Mass. 01201

General Electric Company
Insulating Materials Dept.
1 Campbell Road
Schenectady, N. Y. 12306

General Electric Company
Silicone Products Dept.
Waterford-Mechanicsville Rd.
Waterford, N. Y. 12188

General Mills, Inc.
Chemical Division
S. Kensington Road
Kankakee, Ill. 60901

General Plastics Corp.
55 La France Avenue
Bloomfield, New Jersey 07003

George, P. D., Company
5200 N. Second Street
St. Louis, Mo. 63147

Glastic Corporation
4321 Glenridge Road
Cleveland, Ohio 44121

Goodrich, B. F., Chemical Co.
3135 Euclid Avenue
Cleveland, Ohio 44115

Goodyear Tire & Rubber Co.
Chemical Division
1144 E. Market Street
Akron, Ohio 44316

Goren, H. L., Co.
1514 Van Buren Street
Chicago, Illinois 60607

Gougler, G. L., Machine Co.
705-69 Lake Street
Kent, Ohio 44240

Grat, John C., Co.
501 Central Avenue
Cheltenham, Pa. 19012

Great American Plastics Co.
650 Water Street
Fitchburg, Mass. 01420

Guardian Chemical Corporation
41-45 Crescent Street
Long Island, New York 11101

Gulf Oil Corporation
Plastics Division, Chemicals Dept.
Dwight Building
Kansas City, Mo. 64105

HPM, Division Koehring Co.
Marion Road
Mt. Gilead, Ohio 43338

Hammond Plastics, Inc.
88 Webster Street
Worchester, Mass. 01603

Hardman, H. V., Co., Inc.
575 Cortlandt Street
Belleville, New Jersey 07109

Harwick Standard Chemical Co.
60 S. Seiberling Street
Akron, Ohio 44305

Hastings Plastics, Inc.
1704 Colorado Avenue
Santa Monica, Calif. 90404

Hedrix, Frank, Mold Maker
14908 Verdura Road
Paramount, California 90723

Hercules, Inc.
910 Market Street
Wilmington, Delaware 19899

Herculite Protective Fabrics
661 Fourth Street
Newark, New Jersey 07107

High Strength Plastics Corp.
1401-17 W. Jackson Boulevard
Chicago, Illinois 60607

Hightemp Resins, Inc.
225 Greenwich Avenue
Stamford, Conn. 06902

Holland, M., Company
111 W. Lake Street
Northlake, Illinois 60164

Hoover Ball & Bearing Co.
Subsidiary of Quinn-Berry Corp.
2609 - 17 W. Twelfth St.
Erie, Pa. 48106

House of Vision
135 North Wabash
Chicago, Ill. 60602

Houston Plastic Products, Inc.
13026 Rosecrest Street
Houston, Texas 77035

Howell Industries, Inc.
494 Farnham Avenue
Lodi, New Jersey 07644

Hull Corporation
5001 Davisville Road
Hatboro, Pennsylvania 19040

Hunter Associates Laboratory, Inc.
9529 Lee Highway
Fairfax, Va. 22030

Husky Mfg. & Tool Works, Ltd.
200 Bentworth Avenue
Toronto 19, Ontario, Canada

Hysol Corporation
1100 Seneca Avenue
Olean, New York 14761

ICI - Organics, Inc.
55 Canal Street
Providence, Rhode Island 02901

Imperial Chemical & Plastics Corp.
Mill Street
Cranston, Rhode Island 02905

Improved Machinery, Inc.
150 Burke Street
Nashua, New Hampshire 03060

Incoplas Corporation
674 Pennsylvania Avenue
Elizabeth, New Jersey 07201

Industrial Coatings Company
Derry Court, RFD 5
York, Pennsylvania 17402

Industrial Engineering Service
703 Washington Street
S. Easton, Mass. 02375

Industrial Vinyls, Inc.
3310 NW 30th Street
Miami, Florida 33152

Instrument Development Laboratories
67 Mechanic Street
Attleboro, Mass. 02703

Interchemical Corp.
Finishes Division
1255 Broad Street
Clifton, New Jersey 07015

International Coatings Co.
1441 W. El Segundo Blvd.
Compton, California 90222

Ionac Chemical Co.
Div. Ritter Pfaudler Corp.
Birmingham Road
Birmingham, New Jersey 08011

Isochem Resins Co.
Cook Street
Lincoln, Rhode Island 02865

Jay, T. V., Co., Inc.
1771 Sunnyside Avenue
Chicago, Illinois 60640

Jedco Chemical Corp.
601 MacQuesten Parkway N.
Mt. Vernon, N. Y. 10552

Kard Manufacturing Co, Inc.
5312 Valley Boulevard
Los Angeles, California 90032

Karlton Machinery Corp.
200 E. Ontario St.
Chicago, Illinois 60611

Kawaguchi Iron Works, Ltd.
988 Sodeshi-cho, Shimizu
Shizuoka, Japan

Kelm, G. R., Machine Works
347 E. Railway Avenue
Paterson, N. J. 07503

Kessler Products Co., Inc.
302 McClurg Road
Youngstown, Ohio 44501

Key Polymer Corp.
275 Lowell Street
Lawrence, Mass. 01842

Klenk Epoxy Corporation
9141 E. Jefferson
Detroit, Michigan 48214

Knapp, Fred, Engraving Co., Inc.
5102 Douglas Avenue
Racine, Wisconsin 53402

Knoedler Chemical Company
651 High Street
Lancaster, Pennsylvania

Koppers Co., Inc.
Tar & Chemical Division
1350 Koppers Bldg.
Pittsburgh, Pa. 15219

Kristal Kraft, Inc.
900 Fourth Street
Palmetto, Florida 33561

Kroll Equipment Co.
1623 Milwaukee Avenue
Chicago, Ill. 60647

Kunst, John, Co.
41 Murry Street
New York, N. Y. 10007

Kureha Chemical Industry Co., Ltd.
1-8 Nihobashi Horidome-cho
Cho-ku, Tokyo, Japan

Lakeside Plastics Corp.
3325 N. Shore Drive
Oshkosh, Wisconsin 54901

Lami-Plast Products Co.
7116 N. Habana Avenue
Tampa Florida 33604

Lawton, C. A., Co.
233 N. Broadway
De Pere, Wisconsin

Leal Company
1716 S. Sixth Street
Camden, New Jersey 08104

Leepoxy Plastics, Inc.
Ferguson Road, Baer Field
Fort Wayne, Indiana 46809

Leominster Tool Co., Inc.
272 Whitney Street
Leominster, Mass. 01453

Lester Engineering Co.
2711 Church Avenue
Cleveland, Ohio 44113

Lewis Welding & Engineering Corp.
113 St. Clair Avenue NE
Cleveland, Ohio 44114

Liberty Engineering & Mfg. Co.
1417 W. Ormsby Avenue
Louisville, Kentucky

Liberty Mold & Duplicating Co.
80 Fadem Road
Springfield, New Jersey 07081

Liberty Optical Manufacturing Co., Inc
380 Verona Avenue
Newark, New Jersey 07104

Lite-Kote Plastic Corp.
4488 W. 160th St. & Puritas Ave.
Cleveland, Ohio 44135

Liquid Nitrogen Processing Corp.
415 King Street
Malvern, Pa. 19355

Logan Engineering Co.
Hydraulics Division
4901 W. Lawrence Avenue
Chicago, Ill. 60630

Lombard Industries, Inc.
300 Main Street
Ashland, Mass. 01721

Lorben Corporation
3333 Lawson Boulevard
Oceanside, New York 11572

Luther Mfg. Co., Inc.
J & H Building
Olean, New York

Luzerne Rubber Company
Subsidiary, Beisinger Industries, Ltd.
Muirhead Street
Trenton, New Jersey 08607

M & N Modern Hydraulic Press Co., Inc.
P. O. Box 504
Clifton, New Jersey 07012

M & T Chemicals, Inc.
Woodbridge Avenue
Rahway, New Jersey 07065

Maclin Company
67-6800 Stanford Avenue
Los Angeles, California 90001

Madison Plastic & Mold Co., Inc.
245 Gotzian Road
Madison College, Tenn.

Magnolia Plastics, Inc.
5547 Peachtree Industrial Blvd.
Chamblee, Georgia 30005

Mallinkrodt Chemical Works
3200 N. Second Street
St. Louis, Mo. 63160

Manco Products, Inc.
2401 Schaefer Road
Melvindale, Michigan 48122

Many, J., & Company
153 Lafayette Street
New York, New York 10013

Marblette Corp., The
37-31 30th Street
Long Island City, New York 11101

Marbon Chemical Division
Borg-Warner Corporation
P. O. Box 68
Washington, W. Va. 26101

Marco Chemical Division
W. R. Grace & Company
1711 W. Elizabeth Avenue
Linden, New Jersey

Marine Optical Manufacturing Co.
28 Mahler
Jamaica Plains, Mass. 02130

Marks Polaroid Corporation
Whitestone, Station
Flushing, New York 11357

Marland Mold Co., Inc.
Subsidiary, Greylock Plastics, Inc.
125 Pecks Road
Pittsfield, Mass.

Melamine Plastics, Inc.
Division of Fiberite Corporation
512-28 W. Fourth Street
Winona, Minnesota 55987

Merix Chemical Company
2234 E. 75th Street
Chicago, Illinois 60649

Metachem Resins Corporation
Mereco Products Corp. Div.
539 Wellington Avenue
Cranston, R. I. 02910

Metalead Products Corporation
2901 Park Boulevard
Palo Alto, California 94306

Middlesex Tool & Machine Co.
1157 Globe Avenue
Mountainside, New Jersey 07092

Midland Die & Engraving Co.
502 Factory Road
Addison, Illinois

Miles, A. L., Fiberglass &
Plastic Supply
4060 Wyne Street
Houston, Texas 77017

Miller-Stephenson Chemical Co., Inc.
16 Sugar Hollow Road
Danbury, Conn. 06813

Millmaster Onyx Corporation
99 Park Avenue
New York, New York 10016

Minnesota Mining & Mfg. Co.
2501 Hudson Road
St. Paul, Minnesota 55119

Mitchell Rand Mfg. Corp.
Torne Valley Road
Hillburn, N. Y. 10931

Mitsubishi Rayon Co., Ltd.
8, 2-chome, Kyobashi,
Chu-ku-Tokyo, Japan

Mobay Chemical Co.
Penn Lincoln Pkwy, W.
Pittsburgh, Pa. 15205

Modern Tool & Die Co., Inc.
125 Tolman Avenue
Leominster, Mass. 01453

Mol-Rez Division
Americal Petrochemical Corp.
3134 California Street NE
Minneapolis, Minnesota 55418

Monsanto Company
800 N. Lindbergh Boulevard
St. Louis, Mo. 63166

Moore Chemical Corp.
Whitehorn Way & Kemp Road
Burlingame, California 94010

Morton Chemical Co.
110 N. Wacker Drive
Chicago, Illinois 60606

Moslo Machinery Company
20120 Detroit Road
Cleveland, Ohio 44116

Munray Products Division
Fanner Manufacturing Company
12400 Crossburn Avenue SW
Cleveland, Ohio 44135

NRM Corporation
47 W. Exchange Street
Akron, Ohio 44308

Nattone, Incorporated
425 Park Avenue
New York, New York 10022

National Coating, Inc.
P. O. Box 223
W. Hanover, Mass. 02380

National Lead Company
111 Broadway
New York, New York 10006

National Polychemicals, Inc.
Eames Street
Wilmington, Mass. 01887

National Starch & Chemical Corp.
750 Third Avenue
New York, New York 10017

National Tool & Mfg. Co.
100 N. Twelfth Street
Kenilworth, N. J. 07033

National Vacuum Platers, Inc.
2635 E. Hagert Street
Philadelphia, Pa. 19125

New Britain Machine Co.
307 South Street
New Britain, Conn. 06050

New England Butt Company
Division, Wanskuck Company
304 Pearl Street
Providence, Rhode Island

Newark Die Company
24 Scott Street
Newark, New Jersey

Newbury Industries, Inc.
10975 Kinsman Road
Newbury, Ohio 44065

Nissei Plastics Industrial Co. Ltd.
Sakaki, Hanishina
Nagano-Ken, Japan

Nonweiler, A. P., Co.
P. O. Box 1007
Oshkosh, Wisconsin 54902

Nopco Chemical Company
60 Park Place
Newark, New Jersey 07102

Nordberg Mfg. Company
Hydraulic Press Division
3073 S. Chase Avenue
Milwaukee, Wisconsin 53207

North American Machinery Corp.
60 E. 42nd Street
New York, New York 10017

Nypel Corporation
24 Union Hill Road, W.
Conshohocken, Pennsylvania

O. C. Adhesives Corporation
76 Fourth Street
Brooklyn, New York 11231

OKC Division
The Fanner Manufacturing Co.
Textron, Incorporated
900 N. Chapel Street
Louisville, Ohio

Oakley Die & Mfg. Company
4426 Brazee Street
Cincinnati, Ohio 45209

Ohio Sealer & Chemical Corp.
3060 E. River Road
Dayton, Ohio 45439

Ohnuma Seisakusho Mfg. Co., Ltd.
24-1, 5 Chome, Ohmori-nishi,
Ohta-ku, Tokyo, Japan

Omni Division
C. Tennant, Sons & Co. of New York
100 Park Avenue
New York, New York 10017

Orbit of California
211 Los Molinos
San Clemente, California 92672

Osley & Whitney, Inc.
130 Southampton Road
Wesfield, Mass. 01085

PPG Industries
Coatings & Resins Division
1 Gateway Center
Pittsburgh, Pennsylvania 15222

Pacific Resins & Chemicals, Inc.
3400 - 13th Avenue SW
Seattle, Washington 98134

Packaging Industries
Airport Road
Hyannis, Massachusetts

Pantasote Company
277 Park Avenue
New York, New York 10017

Parcloid Chemical Company
140 Greenwood Avenue
Midland Park, New Jersey 07432

Parco Chemicals, Inc.
P. O. Box 99
Morris Plains, New Jersey 07950

Parr Molding Compounds Corp.
Canal & Ludlow Streets
Stamford, Connecticut 06092

Parsons, M. W., Plymouth Div.
S. B. Penick & Company
100 Church Street
New York, New York 10008

Pasadena Hydraulics, Inc.
1433 Lidcombe Avenue
El Monte, California 91733

Patent Button Company of Tenn.
2221 Century Street
Knoxville, Tennessee 37901

Pennsalt Chemicals Corporation
3 Penn Center
Philadelphia, Pennsylvania 19102

Pennsylvania Industrial
Chemical Corporation
120 State Street
Clairton, Pennsylvania 15025

Perfect Mold Company, Inc.
1500 N. Crooks Road
Clawson, Michigan 48017

Perkin-Elmer Corporation
807 Main Avenue
Norwalk, Conn. 06852

Pfizer, Chas., & Co., Inc.
Industrial Chemicals Div.
235 E. 42nd Street
New York, New York 10017

Pfizer, Chas., & Co., Inc.
Minerals, Pigments & Metals Div.
235 E. 42nd Street
New York, New York 10017

Phelan's Resins & Plastics Div.
Phelan-Faust Paint Mfg. Co.
Oak St. & Bluff Rd.
Burlington, Iowa 52602

Phillips Petroleum Company
Chemical Dept.
Industrial Products Division
Bartlesville, Oklahoma 74003

Pittsburgh Plate Glass Co.
Coatings & Resins Division
1 Gateway Center
Pittsburgh, Pennsylvania 15222

Plamco
15518 S. Broadway
Gardena, California 90247

Plastic Electro-Finishing Corp.
1333 Flushing Avenue
Brooklyn, New York 11237

Plastic Engineering & Mfg. Corp.
2800 S. Elati Street
Englewood, Colorado 80110

Plastic Engineering & Sales Corp.
2628 St. Louis Street
Fort Worth, Texas 76101

Plastic Materials, Inc.
Subsidiary of Columbian Carbon Co., Inc.
New South Road
Hicksville, New York

Plastic Mold Tool & Die Co., Inc.
1 Maple Street
E. Rutherford, New Jersey 07073

Plastic Molding Powders, Inc.
487 Forest Street
Kearny, New Jersey

Plasti-Cast Mold & Products Co.
1430 Archwood Avenue
Akron, Ohio 44306

Plastics Development Corp.
145 Roswell Street
Smyrna, Georgia 30080

Plastics Engineering Company
1607 Geele Avenue
Sheboygan, Wisconsin 53081

Plastima GmbH
Postfach 586
4000 Dusseldorf-Oberkassel,
Germany

Plastimac s.r.l.
Piazzale Giulio Cesare 9
Milano, Italy

Plasti-Vac, Incorporated
526 W. Third Street
Charlotte, N. C. 28203

Plast-O-Craft, Incorporated
391 Mulberry Street
Newark, New Jersey 07102

Plastonics, Inc.
112 Prestige Park Road
E. Hartford, Conn. 06108

Plas-Tool Company
7430 N. Cronamic Road
Niles, Illinois 60648

Plating Engineering Co.
1928 S. 62nd Street
Milwaukee, Wisconsin 53219

Polaroid Corporation
549 Technology Square
Cambridge, Massachusetts 02139

Poly Resins
11655 Wicks Street
Sun Valley, California 91352

Polychrome Dispersions, Inc.
13429 S. Western Avenue
Gardena, California

Polymer Machinery Corporation
60 Woodlawn Road
Berlin, Connecticut

Polyrez Company, Inc.
S. Columbia Street
Woodbury, New Jersey 08096

Polytech Company
10423 Trenton Avenue
St. Louis, Missouri 63132

Polyvinyl Chemicals, Inc.
26 Howley Street
Peabody, Mass. 01960

Precision Products Co., Inc.
262 E. 16th Street
Paterson, New Jersey 07524

Premier Thermo Plastics Co.
3001 Middletown Road
Jeffersontown, Kentucky 40029

Primas Moldmakers, Inc.
T. C. Industrial Park
Depew, New York 14043

Princeton Chemical Research, Inc.
P. O. Box 652
Princeton, New Jersey 08540

Procter & Gamble
Industrial Soap & Chemical Products Div.
P. O. Box 599
Cincinnati, Ohio 45201

Progressive Tool & Die Company
Turnpike Road
Westboro, Massachusetts 01581

Prospect Mold & Die Company
1817 Front Street
Cuyahoga Falls, Ohio 44221

RC Division
Hooker Chemical Corporation
New South Road
Hicksville, New York 11802

Raybestos Manhattan, Inc.
123 Steigle Street
Manheim, Pennsylvania

Rector Engineering & Plastics Co.
318 Randolph Place NE
Washington, D. C. 20002

Ren Plastics, Incorporated
5656 S. Cedar Street
Lansing, Michigan 48909

Research Sales, Incorporated
P. O. Box 358
Suffern, New York 10901

Resinous Chemicals Corp.
1399 W. Blaneke Street
Linden, New Jersey 07036

Rezolin, Incorporated
1651 - 18th Street
Santa Monica, California 90404

Reichhold Chemicals, Inc.
525 N. Broadway
White Plains, New York 10602

Rheinstahl Henschel AG
Postfach 786
35 Kassel-2, Germany

Richardson Company
Insurok Division
2747 Lake Street
Melrose Park, Illinois 60160

Richardson Company
Polymers Division
345 Morgan Lane
W. Haven, Conn. 06516

Rochelle Plastic Mold Co., Inc.
35 Sebago Street
Clifton, New Jersey 07013

Rodgers Hydraulic, Inc.
Molding Press Division
7401 Walker Street
Minneapolis, Minnesota 55426

Roehlen Engraving Works
701 Jefferson Road
Rochester, New York 14623

Rogers Corporation
Rogers, Connecticut 06263

Rohm & Haas Company
Independence Mall W.
Philadelphia, Pa. 19105

Rubba, Incorporated
1015 E. 173rd Street
Bronx, New York 10460

Rudolph-Martin
Maschinen-und Formenbau
Industriestrasse 47
Velbert-Rhld, Germany

Rutgers Metals & Chemicals Co.
P. O. Box 164
New Brunswick, New Jersey

Rutland Plastics, Inc.
215 Foster Avenue
Charlotte, N. C. 28203

St. Lawrence Hydraulic Co., Inc.
2424 Beech Daly Road
Inkster, Michigan 48141

SamSon Molds, Inc.
1028 E. Edna Street
Covina, California 91722

Sarcol, Incorporated
3050 W. Taylor Street
Chicago, Illinois 60612

Sartomer Resins, Incorporated
P. O. Box 56
Essington, Pa. 19029

Saunders Engineering Corp.
4515 Alger Street
Los Angeles, California 90039

Schenectady Chemicals, Inc.
Congress & Tenth Street
Schenectady, New York 12301

7-K Color Corporation
927 N. Citrus Avenue
Hollywood, California 90038

Shamrock-Neatway Products, Inc.
1010 Lyndale Avenue N.
Minneapolis, Minnesota

Shaw, Francis, Ltd. (Canada)
1393 Grahams Lane
Burlington, Ontario, Canada

Shaw Industries, Inc.
RD 2, P. O. Box 591
Franklin, Pennsylvania 16323

Shell Chemical Company
50 W. 50th Street
New York, New York 10020

Shell Chemical Company
Industrial Chemical Division
110 W. 51st Street
New York, New York 10020

Shelmark Industries, Inc.
320 Fletcher Street
Columbus, Ohio 43215

Sherwin-Williams Company
Pigment, Color & Chemical Dept.
101 Prospect Avenue
Cleveland, Ohio 44101

Shin-Etsu Chemical Company
2, Marunouchi 1-chome
Chiyoda-ku, Tokyo, Japan

Shuron/Continental Company
40 Humboldt
Rochester, New York 14609

Silmar Chemical Corporation
Subsidiary of Standard Oil Co. of Ohio
12333 S. Van Ness Avenue
Hawthorne, California 90250

Sinclair Petrochemicals, Inc.
600 Fifth Avenue
New York, New York 10020

Smooth-On Manufacturing Co.
572 Communipaw Avenue
Jersey City, New Jersey 07304

Solar Chemical Corporation
34 Monument Square
Leominster, Massachusetts 01483

South Bend Lathe
400 W. Sample Street
South Bend, Indiana 46623

Spectrolab Division
Textron Industries
12484 Gladstone Avenue
Sylmar, California 91342

Spencer Kellogg Division
Textron, Incorporated
120 Delaware Avenue
Buffalo, New York 14240

Springfield Cast Products, Inc.
124 Switzer Avenue
Springfield, Mass. 01109

Stanchel Engineering Co.
5416 Cleon Street
North Hollywood, California

Standard Polymers, Inc.
1 Riverdale Avenue
Bronx, New York 10463

Standard Tool Company
217 Hamilton Street
Leominster, Mass. 01453

Stauffer Chemical Company
Plastics Division
299 Park Avenue
New York, New York

Steelcote Manufacturing Co.
3418 Gratiot Street
St. Louis, Missouri 63103

Steere Enterprises, Inc.
285 Commerce Street
Tallmadge, Ohio 44278

Sterling Extruder Corporation
1537 W. Elizabeth Avenue
Linden, New Jersey 07036

Sterling Varnish Company
Haysville Borough
Sewickley, Pennsylvania 15143

Stokes Equipment Division
Pennsalt Chemical Corporation
3 Penn Center
Philadelphia, Pennsylvania 19102

Stokes-Trenton, Incorporated
150 Enterprise Avenue
Trenton, New Jersey 08602

Stricker-Brunhuber Corporation
19 W. 24th Street
New York, New York 10010

Sun Chemical Corporation
Chemical Products Division
400 Old Dublin Pike
Doylestown, Pennsylvania 18901

Sun Chemical Corporation
Electro-Technical Products Div.
113 E. Centre Street
Nutley, New Jersey 07110

Sun Chemical Corporation
Specialty Chemicals Dept.
631 Central Avenue
Carlstadt, New Jersey

Swift & Company
Chemicals for Industry Dept.
115 W. Jackson Boulevard
Chicago, Illinois 60604

Symons, Ralph B., Assoc., Inc.
P. O. Box 37
Tiverton, Rhode Island 02878

Synco Resins
ADM Chemicals
Archer Daniels Midland Co.
30 Henry Street
Bethel, Connecticut 06801

Synthetic Products Company
1636 Wayside Road
Cleveland, Ohio 44112

Synvar Corporation
726 King Street
Wilmington, Delaware 19801

Tavannes Machines Company, S.A.
Rue Sandoz 2710
Tavannes, Switzerland

Tech Consolidated, Inc.
20 Dickey Street
Derry, New Hampshire 03038

Techform Laboratories, Inc.
707 W. Washington Boulevard
Venice, California 90291

Tenneco Chemicals, Inc.
Nuodex Division
1 Virginia Street
Elizabeth, New Jersey

Tenneco Chemicals, Inc.
Tenneco Plastics Division
Ryders Lane
East Brunswick, N. J. 08816

Testing Machines, Inc.
72 Jericho Turnpike
Mineola, New York 11501

Terrafluor Division
Amerco, Incorporated
343 Hindry Avenue
Inglewood, California 90301

Texas Chemical & Plastics Corp.
970 E. Maple
Birmingham, Michigan 48011

Thermoset Plastics, Inc.
5010 E. 65th Street
Indianapolis, Indiana 46220

Thermtrol Corporation
165 Holland Avenue
Bridgeport, Connecticut 06605

Thiokol Chemical Corporation
Chemical Division
780 N. Clinton Avenue
Trenton, New Jersey 08607

Thombert, Incorporated
316 E. Seventh Street N.
Newton, Iowa 50208

Thompson Apex Company
505 Central Avenue
Pawtucket, R. I. 02862

Tilp, J. G., Inc.
60 Miltown Road
Union, New Jersey 07083

Titmus Optical Company
1015 Commerce
Petersburg, Va. 23803

Toyad Corporation
P. O. Box 30
Latrobe, Pennsylvania 15650

Tra-Con, Incorporated
25 Commercial Street
Medford, Mass. 02155

Trim Molded Products Corp.
Route 5, Box 25
Burlington, Wisconsin 53105

Triulzi, S. p. a.
Via Per Vialba 56
Novate Milanese, Italy

Tronomatic Corporation
25 Bruckner Boulevard
Bronx, New York 10454

Trueblood, Incorporated
516 N. Irwin Street
Dayton, Ohio 45403

Tylac Chemicals Division
International Latex & Chemical Corp.
Dover, Delaware 19901

Ube Industries, Ltd.
1976 Ogushi Ube-Shi
Yamaguchi-Ken, Japan

Union Carbide Corporation
Chemicals Division
270 Park Avenue
New York, New York 10017

Union Carbide Corporation
Plastics Division
270 Park Avenue
New York, New York 10017

Uniroyal, Incorporated
1230 Avenue of the Americas
New York, New York 10020

U. S. Industrial Chemical Co.
Division of National Distillers &
Chemical Corporation
99 Park Avenue
New York, New York 10016

United States Gypsum Company
101 S. Wacker Drive
Chicago, Illinois 60606

U. S. Industries, Inc.
Production Machine Division
6499 W. 65th Street
Chicago, Illinois 60638

United States Rubber Company
1230 Avenue of the Americas
New York, New York 10020

Universal Optical Company
23 Acorn
Providence, Rhode Island 02903

Universal Plastics Corporation
352 Harrison Street
Passaic, New Jersey 07056

Vacform Company
8 Lois Street
Norwalk, Connecticut 06851

Valite Division
Valentine Sugars, Inc.
726 Whitney Bldg.
New Orleans, Louisiana

Van Dorn Plastic Machinery Co.
2085 E. 79th
Cleveland, Ohio 44104

Vanderbilt, R. T., Co., Inc.
230 Park Avenue
New York, New York 10017

Vernon-Benshoff Co., Inc.
413 N. Pearl Street
Albany, New York 12201

Verson Allsteel Press Co.
1355 E. 93rd Street
Chicago, Illinois 60619

Vogt Manufacturing Corporation
100 Fernwood Avenue
Rochester, , New York 14621

Wabash Metal Products Co., Inc.
1569 Morris Street
Wabash, Indiana 46992

Ware Chemical Corporation
P. O. Box 783
Westport, Connecticut 06881

Western Coating Company
Stephenson Highway at 14-1/2
Mile Road
Royal Oak, Michigan 48073

Westwood Chemical Co., Inc.
801 Second Avenue
New York, New York 10017

Whitford Chemical Corporation
20 N. Matlack Street
W. Chester, Pennsylvania 19380

Wilco Company
4425 Bandini Boulevard
Los Angeles, California 90023

Williamson Adhesives, Inc.
8220 Kimball Avenue
Skokie, Illinois 60076

Williams-White & Co.
600 Third Avenue
Moline, Illinois 61265

Windsor, R.H., Ltd.
Leatherhead Road
Chessington, Surrey, England

Witco Chemical Company, Inc.
277 Park Avenue
New York, New York 10017

Woodmont Products, Inc.
County Line & New Road
Huntingdon Valley, Pennsylvania

Younger-Med Optics
3788 Broadway Place
Los Angeles, California 90007

Youngstown Vinyl Compounds, Inc.
4521 Lake Park Road
Youngstown, Ohio

Zack Radiant Heat Company
122 Fayette Avenue
Wayne, New Jersey 07470

APPENDIX III

SAMPLES OF LETTERS SENT TO SUPPLIERS AND MANUFACTURERS

LIFE SYSTEMS RESEARCH INSTITUTE

1801 Avenue of the Stars, Suite 802, Los Angeles, California 90067

Gentlemen:

Life Systems Research Institute is conducting a feasibility study for the U. S. Army Medical Research and Development Command under Contract DADA 17-69-C-9062 for the development of a new optical laboratory for military field use.

As part of this study a survey of plastic material capable of being used for ophthalmic lenses is being made. From this survey materials of suitable quality will be further evaluated.

Initially the prime requisite is for materials that are transparent with further evaluation being made on the basis of the other characteristics of the materials. Of special interest would be new materials, or materials under development.

It would be of great help to this research effort if you could provide information concerning any of your plastic materials that you consider might fulfill the requirement. Please include the properties of the substance if available.

Life Systems Research Institute is a non-profit corporation primarily engaged in health/medical research and has no proprietary interests.

Any assistance you may be able to offer will be greatly appreciated.

Sincerely,

J. T. Celentano, M.D.
Project Manager
Army Field Lens Project

JTC:pf

LIFE SYSTEMS RESEARCH INSTITUTE

1801 Avenue of the Stars, Suite 802, Los Angeles, California 90067

Gentlemen:

Life Systems Research Institute is conducting a feasibility study for the U. S. Army Medical Research and Development Command under Contract DADA 17-69-C-9062 for the development of a new optical laboratory for military field use.

As part of this study a survey of plastic materials, techniques, and devices suitable for optical/ophthalmic lens and frame processing is being made. From this survey materials, techniques, and devices suitable for field use will be identified. Of special interest would be: automated techniques, devices capable of being carried by a 1-1/2 ton truck, and new developments.

It would be of great help to this research effort if you could provide information concerning any materials, techniques, processes, or devices that you consider might fulfill this requirement.

Life Systems Research Institute is a non-profit corporation primarily engaged in health/medical research and has no proprietary interests.

Any assistance you may be able to offer will be greatly appreciated.

Sincerely,

J. T. Celentano, M.D.
Project Manager
Army Field Lens Project

JTC:pf

LIFE SYSTEMS RESEARCH INSTITUTE

1801 Avenue of the Stars, Suite 802, Los Angeles, California 90067

Gentlemen:

Life Systems Research Institute is conducting a feasibility study for the U. S. Army Medical Research and Development Command under Contract DADA 17-69-C-9062 for the development of a new optical laboratory for military field use.

As part of this study a survey of plastic lens and frame materials and processes is being made. From this survey items suitable for a new field optical laboratory will be identified. Of special interest would be: new developments, automated techniques, and devices for producing plastic lenses or frames that could be transported by a 1-1/2 ton truck.

It would be of great help to this research effort if you could provide information concerning materials, techniques, or devices that you consider might fulfill this requirement.

In addition, a visit to your plastic lens processing facilities would be extremely helpful if this can be arranged.

Life Systems Research Institute is a non-profit corporation primarily engaged in health/medical research and has no proprietary interests.

Any assistance you may be able to offer will be greatly appreciated.

Sincerely,

J. T. Celentano, M.D.
Project Manager
Army Field Lens Project

JTC:pf

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1801 Avenue of the Stars, Suite 802, Los Angeles, California 90067

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It would be of great help to this research effort if you could provide information concerning materials, techniques, or devices that you consider might fulfill this requirement.

In addition, a visit to your plastic frame processing facilities would be extremely helpful if this can be arranged.

Life Systems Research Institute is a non-profit corporation primarily engaged in health/medical research and has no proprietary interests.

Any assistance you may be able to offer will be greatly appreciated.

Sincerely,

J. T. Celentano, M. D.
Project Manager
Army Field Lens Project

JTC:pf

LIFE SYSTEMS RESEARCH INSTITUTE

1301 Avenue of the Stars, Suite 802, Los Angeles, California 90067

Gentlemen:

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It would be of great help to this research effort if you could provide information concerning materials, techniques, or devices that you consider might fulfill this requirement.

As this program is being conducted in association with Univis, Inc., you may have received a similar query from them. However, as you are a prominent supplier in this field it is important that your contributions to the plastics industry not be overlooked.

Life Systems Research Institute is a non-profit corporation primarily engaged in health/medical research and has no proprietary interests.

Any assistance you may be able to offer will be greatly appreciated.

Sincerely yours,

J. T. Celentano, M.D.
Project Manager
Army Field Lens Project

JTC:pf

UNIVIS
APPLIED PLASTICS PLANT
355 FARMINGDALE ROAD
WEST BABYLON, NEW YORK 11704

PHONE
(516) 661-3710

June 23, 1969

Attention: Director of Research & Development

Gentlemen:

We have recently received a contract in response to RFP DADA 17-69-R-9002 from the U. S. Army Medical Research & Development Command to conduct a "Feasibility Study of Automatic Fabrication of Spectacle Lenses".

As a phase of this study, we intend investigating all currently available, suitable plastic materials as well as those in the development stage. This would include both transparent plastics and abrasion resistant coatings.

Since you are an outstanding leader in the field of plastic developments I'm confident there are some current projects in your laboratories which would prove of value for this study.

I'd be privileged if an appointment could be arranged at which these developments could be discussed.

Sincerely,

M. Greshes
Vice President
Research & Development

MG:ts

UNIVIS®
APPLIED PLASTICS PLANT
355 FARMINGDALE ROAD
WEST BABYLON, NEW YORK 11704

PHONE
(516) 661-3710

June 20, 1969

Gentlemen:

We have recently received a contract from the U. S. Army Medical Research & Development Command to evaluate the possible use of plastic for spectacles and lenses.

In this connection, we are interested in evaluating all transparent plastics, rigid or flexible, for possible lens application. We are also interested in evaluating any material (transparent or opaque) that would have properties especially exotic for spectacle frame application.

This is an extensive study which we can properly execute only with the cooperation of industry and the universities. We, therefore, solicit your assistance and request samples of any materials of your manufacture which you consider applicable.

For our evaluation, we would require approximately one to two square feet of material, if available in sheet form (thickness of .060" is desired though any other available thickness is usable). If samples exist in the form of standard plastic chips, then 24 such chips would equally serve our purpose.

Thank you for your kind consideration.

Very truly,

M Greshes

M. Greshes
Vice President
Research & Development

MG:ts

June 20, 1969

Gentlemen:

We have recently received a contract from the U. S. Army Medical Research & Development Command to evaluate the possible use of plastic for spectacles and lenses.

In this connection, we are interested in evaluating all transparent plastics, rigid or flexible, for possible lens application. We are also interested in evaluating any material (transparent or opaque) that would have properties especially exotic for spectacle frame application.

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and any other materials of your manufacture which you consider applicable.

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Thank you for your kind consideration.

Very truly,

M. Greshes
Vice President
Research & Development

MG:ts