RINCON INDIAN RESERVATION

MATERIAL SYSTEMS CORPORATION

- CONFIDENTIAL -

INFORMATION MEMO OCTOBER, 1970

TABLE OF CONTENTS

Preface. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . Section 1

Description of company and
current activities . . . . . . . . . . . . . . . . . . . . . . . . . . . Section 2

The MSC Housing Concept . . . . . . . . . . . . . . . . . . . . . Section 3

The management team and
organization . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . Section 4

Photographs and renderings . . . . . . . . . . . . . . . . . . . . . Section 5

Operation Breakthrough . . . . . . . . . . . . . . . . . . . . . . . Section 6

U. S. Financial Annual Report . . . . . . . . . . . . . . . . . . . . Section 7

Stockholders and Directors . . . . . . . . . . . . . . . . . . . . . . Section 8

News Articles . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . Section 9

Financial Statements . . . . . . . . . . . . . . . . . . . . . . . . . . Section 10

Appendix . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . Section 11
The New Industries and Their Dynamics

Yet the plastics, technologically, are only the beginning of the new materials technology, and a limited beginning at that. For the plastics are still based on the old idea of one discrete substance that serves as the "material." What is being realized more and more is our ability to design composite materials in which different structural elements serve different purposes—just as in building a house, timber may carry the load while brick provides the insulation. Increasingly being designed are "composites," combining, for instance, the great strength of pure crystals of metals with the elasticity of organic compounds. The result of these composite designs is one new material that has specific and totally new properties. The starting point is not a substance but a specific microstructure of atoms and molecules and the physical, chemical, and electrical characteristics of such a structure under the laws of quantum mechanics.

This has been carried furthest in space technology, if only because the need for specific performances is greatest there, while the penalties for excess weight or excess bulk are highest. Hence "materials" is one area where one can expect a "fall-out" from space technology into the civilian peacetime economy.

General Schriever, the former head of the Air Force's space and design work, has called the new space materials "the greatest single advance that has been made in the last three thousand years," and his enthusiasm seems only slightly exaggerated.

One of the new materials developed for use in advanced airplane design is, for instance, twice as strong and two and a half times as stiff as aluminum yet weighs 25 per cent less and should, eventually, be considerably less expensive. It is a composite in which tiny fibers made from pure boron crystal are imbedded in a plastic resin. There are many similar materials, usually combining a metal in pure crystal form with some organic material such as a plastic (but also with inorganic materials such as silicones and glass), all of which are stronger than anything found in nature, or capable of greater resistance to heat or to chemicals—and yet lighter and cheaper—than traditional metals.

More important than any one new material or any one new application is the new "materials" concept itself. It marks a shift from concern with substances to concern with structure, a shift from artisan to scientist as man's artificer, a shift from chemistry to physics as the basic discipline, and a shift, above all, from the concrete experience of the workshop to abstract mathematics, a shift from starting with what nature provides to what man wants to accomplish.

The "materials revolution" will predictably make countries less and less dependent on natural resources, since the same end use can be satisfied by starting with almost any natural resource, organic or inorganic. It will make end users increasingly independent of specific substances. It will make possible an enormous number of new products, new satisfactions, and new markets.

1/ Reprinted from the section which analyzes "the explosion of the new technology that will result in major new industries."
INTRODUCTION

For the past two decades, the aerospace industry has developed an assortment of extraordinary structural materials for use in space vehicles and high-performance aircraft. Under the sponsorship of the United States Government, millions of dollars have been spent in the creation and refinement of aerospace-oriented composite material technology. Material Systems Corporation (MSC) was organized to pioneer the development and exploitation of the commercial potential of this technology; specifically, the creation and volume production of cost-effective composite building materials and structures.

THE HOUSING CONCEPT

MSC analyzes product requirements, designs composite materials to satisfy the requirements and develops production techniques for volume manufacture. The total systems approach, from creation of materials through uniquely appropriate manufacturing techniques, results in superior housing units at projected costs far below those constructed with conventional materials.

To demonstrate the concept, several prototype homes were constructed on the Rincon Indian Reservation. An Indian reservation was chosen both to minimize initial building code and union problems and to test the Company's theory that unskilled labor could be effectively utilized in the manufacture of its unique product. An MSC 1700 square foot, three bedroom, two bathroom prototype home has the architectural appearance of adobe brick walls, Spanish tile roof, rustic wood beamed ceiling and massive hand-carved Spanish style doors. The house, however, is constructed of composite materials and was designed to sell for approximately $10,000 -- this price includes the foundation, forced-air heating, a range, oven and garbage disposal.

MSC composite material homes are not "cheap"; the quality and features inherent in the product are unquestionably superior in many respects to homes constructed of conventional building materials. MSC dwellings are structurally sound, aesthetically appealing, functionally efficient, fire retardant, insect and vermin proof, permanently colored, and maintenance free. They are extremely cost-effective however, and offer unprecedented value to the consumer.

1. The term "composite describes a broad range of material systems. The field of interest to MSC includes at present, systems comprising fibers (natural and synthetic), polymer matrices and particularized fillers. MSC composite material technology involves the mechanical and chemical integration of dissimilar materials into unified building components or sub-systems having predetermined structural and aesthetic qualities.
OPERATION BREAKTHROUGH

MSC is one of 22 companies, out of a total of 650 competitors, selected by the Department of Housing and Urban Development (HUD) and awarded a contract under the provisions of the Operation Breakthrough Program. The objective of this program is large-scale production and marketing of low cost quality housing.

The program has three phases: Phase I involves the design and engineering of prototype dwellings for erection during Phase II on HUD designated sites in various parts of the United States. Phase III is envisioned as the volume production and mass marketing of these homes.

The Company received the first Phase I Breakthrough contract awarded under the program. The contract is a $242,000 cost-plus fixed fee type scheduled to cover a 24-week Phase I design and engineering effort. The Company's architect for Operation Breakthrough is Skidmore, Owings and Merrill.

MSC is the only company among all Breakthrough winners that is scheduled to construct prototypes on seven of the eight Breakthrough sites -- more than twice as many sites as any other Breakthrough Housing Systems Producer. Current plans include construction of a total of 110 units during Phase II on sites in the vicinity of

- Kalamazoo, Michigan
- Sacramento, California
- St. Louis, Missouri
- Macon, Georgia
- Memphis, Tennessee
- Indianapolis, Indiana
- Seattle, Washington

The MSC product mix includes single family unattached homes, single family attached row housing, town houses, and low rise garden apartments. No other Breakthrough winner is scheduled to construct as broad a variety of dwellings. The Phase II portion of the contract will be cost plus fixed fee and should exceed two million dollars.

HOUSING SYSTEM

The design iteration between MSC and Skidmore, Owings and Merrill has resulted in a housing system that is heralded by knowledgeable and disinterested professionals as a quantum jump in design optimization.

With a limited number of interchangeable standard components -- five vertical panels, three roof sections and three floor systems -- a wide variety of dwellings can be created including 2, 3, 4 and 5 bedroom single family unattached homes, attached row houses, garden apartments, town houses and low rise apartments. The implications of this design accomplishment are compelling:

- The repetitive and non critical nature of the component manufacturing process suggests higher productivity per direct labor hour than previously experienced or anticipated;
- Optimum quantity production runs can be determined and controlled through known quality and cost assurance techniques;
An unusually dependable basis for accurate budgeting, forecasting and performance measurement will be provided;

Material handling, inventory control and storage problems will be minimal; and

Product adaptability to changing market conditions and housing type preferences will be immediate -- the manufacturing process will be virtually unaffected by demand shifts from, for example, single family homes to town houses.

A detailed description of the MSC Housing System may be found in section 3.

FACILITIES

Existing facilities are suitable for research and development and Construction of prototypes and include a 7000 square foot steel and composite material machine shop, 4 pilot production lines housed in quonset huts and a 1750 square foot prototype house which is utilized as an office complex. Four acres are currently being leased.

In the immediate future a production plant of approximately 70,000 square feet will be secured in San Diego County for primary and full scale manufacture of housing destined for Breakthrough sites throughout the country and non-Breakthrough markets in the western part of the United States.

A second facility for assembly of subsystem components into modules, will be established in the vicinity of Missouri for service to Breakthrough sites and commercial markets within a several hundred mile radius.

CODES AND UNIONS

FHA (233) approval has been secured based upon the first MSC housing unit produced. Four three-section mobile homes have been approved by California state and local authorities for sale and emplacement in a large commercial mobile home park in San Diego.

It is expected that housing units in the terminal design and engineering phase at this time will be approved by HUD, the National Bureau of Standards, the National Academy of Science, the International Council of Building Officials (ICBO) and will receive blanket acceptance by those states which have enacted a factory built housing law.

Preliminary discussions with national officers of two building-trades - oriented unions suggests that 1) the MSC housing system will be accepted by organized labor; and 2) mutually acceptable labor agreements can be established.

U. S. FINANCIAL

In December 1969, U. S. Financial invested $500,000 for a one-third interest in the company. A limited partnership was formed as the investment vehicle with MSC transferring all of its assets and liabilities to the partnership, and having the operational responsibility as General Partner.
In July 1970, the partnership was dissolved, in accordance with the partnership agreement, and U. S. Financial's one-third partnership interest was exchanged for $900,000 of preferred stock in MSC, convertible into 250,000 shares of MSC common stock. U. S. Financial intends to convert its preferred into common stock in the immediate future.

U. S. Financial is a fully-integrated producer and manufacturer of shelter, with complete in-house capability and control of each element from architecture, design, production and manufacturing, and marketing to the financing of the final purchaser. In 1969 the Company produced and sold 4,189 units of shelter and has programmed 7,870 for 1970.

U. S. Financial and MSC are working closely to coordinate and augment each other's distinctive competence for rapid and large scale participation not only in Phase III of Operation Breakthrough but in the commercial or private development sector as well.

FOREIGN VENTURES

MSC's composite material system is ideally suited for under-developed or resource-scarce foreign countries. Communications are being received at an increasing rate from foreign governments and foreign nationals interested in developing licensing agreements, joint ventures and technical services contracts based on MSC's composite material technology.

One such agreement has been formalized with a Latin American investment group (see letter in appendix). Representatives of an Iranian industrial group have made a second visit (in September 1970) to our facilities for comprehensive technical briefings and an exploration of the requirements for a commercial relationship with MSC.

The magnitude of revenues from foreign operations -- joint ventures, technical services contracts, licenses, royalties, -- are being assessed at this time. Preliminary indications suggest that revenues from such activities could be substantial.

PUBLIC STOCK OFFERING

MSC received a letter of intent from C. E. Unterberg, Towbin Co., New York City dated March 26, 1970, relative to a public stock offering of 250,000 shares of common stock at $10 per share, implicitly valuing the Company at $10 million dollars. In preparation for the underwriting an audit was recently completed by Price Waterhouse. The law firm of Strook, Strook and Levan, New York City, has been retained as the Company's legal council for registration and other SEC matters.

The public offering, originally scheduled for September 1970, was postponed by mutual agreement between the Company and the underwriters in light of unfavorable market conditions and a private placement of $1,690,000 with a Latin American investment group (see appendix for letter of agreement). Unterberg, Towbin Co. has expressed the desire to underwrite a public stock offering at the conclusion of the private placement and at the commencement of initial full scale production.
CORPORATE PHILOSOPHY

Composite materials will revolutionize the building materials and construction industries of the world during the 70's just as nylon and rayon in the 30's revolutionized the world's textile and garment industries. Composite raw materials are plentiful and comparatively inexpensive. The manufacturing processes based on the unique nature of composite materials suggest technological and production efficiencies and economies previously considered impossible to attain.

MSC's corporate objectives are the world-wide exploitation of composite material technology to satisfy the urgent and almost overwhelming need for quality shelter at sensible cost.

SUMMARY

MSC is a start-up new technology enterprise which, in April 1969, consisted of several individuals and a unique concept for the design and manufacture of quality low cost housing. A team of aerospace engineers with extensive experience in the development of high performance man-made materials (composites) was organized to apply composite technology to the development of cost-effective building materials and structures.

By July 1970 a million dollar research and development program had been completed, five successful prototype homes had been built, a production plant constructed, a work force recruited and trained, and the threshold from R&D into high volume production about to be crossed; additionally, MSC was one of 22 companies selected from 650 competitors, to receive HUD funding under Operation Breakthrough.

It is noteworthy that in excess of five million dollars will have been invested in MSC by the time the Breakthrough prototypes are completed and the company enters its third phase of growth through the establishment of additional manufacturing plants in major markets.

In an 18-month period the Company was managed from the idea stage to a position of commercial viability with compelling potential.
DESCRIPTION OF THE MSC HOUSING SYSTEM
INTRODUCTION TO THE MSC HOUSING SYSTEM

1. General Description

The MSC housing system is a unique approach to factory built housing. Through design optimization a limited number of structural elements can be inter-related to provide an infinite variety of floor plans. The range of housing systems possible are:

- single family detached units,
- townhouses, and
- multiple family low-rise apartments.

The elements consist of:

- five standard size walls
- three standard size roofs, and
- three standard size floors.

These elements are constructed from a MSC developed composite material utilizing an engineered blend of glass fibers, resin and earth. The method of construction utilizes a sandwich with stressed skins. Two thin composite material skins are bonded on either side of a composite material corrugated core to form the walls and the roof elements. These elements are then assembled on a traditional wood floor system and interlocked by a joint element which bonds the structural elements together. This joint provides both strength and trim.

All electric and mechanical systems are attached or enclosed in the floor element. All above floor electrical outlets and switches are enclosed in the joint element. A kitchen wall and a bathroom wall common to all plans provide mechanical outlets to the various service units.

These elements are constructed into modules. The modules are delivered to the site and upon connection create an efficient and attractive living unit. The resulting housing system is superior in that the structure is:

- permanently colored (never requires painting),
- insect and vermin proof,
- resistant to cracking and chipping,
- acoustically and thermally insulated,
- fire retardant,
- fail safe in earthquake areas,
- maintenance free,
- aesthetically attractive, and
- cost effective.
All systems include oven, range, forced air heating, garbage disposals, carpeting, and washer and dryer outlets. Options are available for air conditioning, dishwashers, garages and carports.

1.2 Materials of Construction

The MSC housing system makes extensive use of composite materials. The formulation was developed by MSC and utilizes a precise ration of fiber reinforcement, polyester resin, and particularized earth. Glass fibers were selected for use in early production phases for reinforcement for the following reasons.

- previously established aerospace standards,
- process equipment suitability, and
- availability.

It is MSC's long range plans to substitute organic fibers because of satisfactory strength and lower costs. However, additional processing studies will be required prior to their use in production structures.

The polyester resin used is a special MSC formulation. It is adapted for use with large volumes of earth filler. It is designed with an ultra-violet absorber for improved weather resistance. It is fire retardant, and is designed to be odorless after cure. This resin system has the unique characteristics required for successful utilization in the MSC structural systems.

A material testing program was initiated to qualify these materials for design. A typical stress-strain curve is presented in Figure 1. Minimal design properties that have been established for their material are presented below.

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compressive Strength</td>
<td>10,000 psi</td>
</tr>
<tr>
<td>Compressive Moduar</td>
<td>$1.0 \times 10^6$ psi</td>
</tr>
<tr>
<td>Tensile Strength</td>
<td>5,000 psi</td>
</tr>
<tr>
<td>Tensile Modulus</td>
<td>$1.0 \times 10^6$ psi</td>
</tr>
<tr>
<td>Shear Strength</td>
<td>5,000 psi</td>
</tr>
<tr>
<td>Density</td>
<td>0.065 lb/in$^3$</td>
</tr>
<tr>
<td>Thermal Conductivity</td>
<td>0.20 Btu/h Ft. °F</td>
</tr>
<tr>
<td>Thermal Expansions</td>
<td></td>
</tr>
<tr>
<td>Coefficient</td>
<td>$8.0 \times 10^{-6}$ in/in/°F</td>
</tr>
</tbody>
</table>

The material is color impregnated with an exterior coat of special polyester of the same color. This creates a permanently colored surface. The system is also fire retardant and insect resistant.

MSC has designed the material for an infinite life when exposed to any climate. Although this can only be proved by real time exposure. The composite as utilized in the MSC system is designed with an exterior protective surface coating which acts both as an erosion shield and an
Figure 1. Typical Stress-Strain Curve for MSC Structural Composite
ultra-violet radiation screen. As stated above the polyester resin also has an ultra-violet absorber which provides additional protection against photo chemical breakdown. This is discussed in more detail in Appendix A which also provides test data on exposure of composite materials in Alaska, Canada, Panama, New Mexico, Florida, Wisconsin and New York.

Other materials utilized in the system consist of adhesives which are used to chemically join all structural elements together. These adhesives utilize the same chemical base and ultra-violet absorbers as the polyester resin in the composite material. In addition, standard construction grade lumber is used in the floors and a limited use of steel rods and clips are used in the wall and roof structure. Concrete is used for the pier or stem wall foundations.

The plumbing system utilizes copper pipes for water, cast iron pipe for gas and plastic pipe for sewage.

The electrical system utilizes the same materials as in traditional construction.

1.3 Elements

1.3.1 Wall Panels

The wall panels utilized in the MSC structural system are self-framing, full-load bearing structural elements, which are designed to resist all roof live and dead loads, and lateral wind and seismic loads acting on the structure. The only secondary framing elements used, are beams and posts in places where architectural design requires large open areas without support walls.

Wall panels are manufactured in five different modular sizes, 30, 40, 70, 100 and 140 inches wide; all having the same height of 8 feet.

As shown in Figure 2 the wall panels consist of two thin skins made of MSC structural composite separated by vertical stiffeners formed by corrugated sheets of the same MSC structural composite material. The two skins and corrugated core are adhesive bonded to form a high strength and very stiff sandwich panel.

The vertical cavities formed by the corrugated core are filled with proper amounts of particules or fiberous insulating material to provide the desirable level of thermal insulation required by local climatic conditions.

When joined to roof and floor, and adjacent panels each wall element becomes completely sealed by the adhesive bond used in all structural joints. At top and bottom the wall panels slide over continuous key elements attached to roof and floor as shown in Figure 3. Between panels the joints are formed by molded MSC composite shapes as shown in Figure 4.
FIG. 2  TYPICAL WALL PANEL
FIG 3. TYPICAL WALL/ROOF AND WALL/FLOOR JOINTS
FIG 4.  TYPICAL WALL JOINTS
1.3.2 Roof Panels

Sandwich construction, similar to that of the wall panels previously described, is utilized in the roof structure. The flat roof panels are manufactured in three modular sizes, with approximate dimensions of 12' x 24', 12' x 36', and 12' x 48'.

As shown in Figure 5 the sandwich roof panel consists of two skins made of MSC structural composite and corrugated core as in case of the wall panels. Insulation is provided by foam or fibrous filler materials in the core cavities. The edges of the panels are closed out by wood members providing local reinforcement against bearing loads and facilitating mechanical attachment of steel hold-down and lifting rods.

The composite skin top surface of the roof provides excellent weather protection and should assure maintenance free operation throughout the life of the structure.

1.3.3 Floor Panels

The floor panels utilized in the present designs of the MSC housing system are of conventional wood construction, consisting of wood joists and plywood sheeting.

Floor panels are fabricated in three modular sizes, corresponding to the three roof panel sizes with approximate dimensions of 12' x 24', 12' x 36', and 12' x 48'.

In the case of two story structures the bottom of the second story floor is sheeted with gypsum board which is sprayed with a layer of MSC composite material forming the ceiling surface.

Research work is currently being conducted by MSC toward the development of a more efficient floor system utilizing MSC composite materials to replace the wood structure. Structural performance of advanced MSC floor designs is superior to the state-of-the-art wood flooring systems, however, cost effective production of the new designs requires additional development work.

1.3.4 Utility System

All utility systems, as much as practical, are installed in the floor of the modular housing units.

Electrical System - All wiring, including plug outlets are floor mounted with the exception of heavy service areas such as the kitchen and utility room. The floor installation keeps most walls free of wiring facilitating the high degree of standardization of walls necessary for efficient mass production. In the few cases where wall
mounted fixtures are necessary such as switches and wall lights these are incorporated in special joint elements prewired for these applications.

In the heavy service requirement areas specially designed utility walls are used. Two such walls, one for kitchen and one for bath rooms, have been designed with all the necessary wiring, plumbing, and ducting to serve all of the various housing units presently being offered by MSC.

The electrical system utilized in the MSC housing units conforms to the National Electrical Code.

Plumbing - The design and installation of all plumbing utilized in the MSC Housing System conform to the National Plumbing Code and/or the Uniform Plumbing Code.

ABS plastic drain piping is used above ground. All water piping inside the house is copper. Galvanized iron gas piping is used throughout.

Fiberglass shower and bathtub stalls are used in all MSC homes. Conformance of these units to USASI Standard Z124.1 and the use of fire-retardant materials is certified by the supplier.

Mechanical Equipment - All mechanical equipment utilized in the MSC Housing System, and their installation conform to the Uniform Mechanical Code.

All MSC Housing units are equipped with forced air heating system consisting of gas furnace units and ducted air supply to each room. All furnace units are adoptable to installation of air conditioning which is optional.

1.4 Foundation Design

The MSC modular housing system can be installed on a wide variety of foundation systems depending on local soil conditions and topography.

The two most frequently used foundation systems for MSC housing units are perimeter stem wall with pier footings under interior load bearing walls or pier footings with grade beams under both the interior and perimeter walls.

1.5 Construction Technique

The MSC housing system utilizes the more efficient aspects of panular and modular construction. The system of construction is in the following sequential steps.
- A continuous production of the structural elements is maintained. The elements are produced on a statistical basis established from the projected sales of the various systems and floor plans. These elements are placed in inventory for assembly.

- The floor element is moved to the assembly area on a transporter, as shown in Figure 6.

- The wall elements are removed from inventory and assembled to the floor element as shown in Figure 7.

- The roof element is then joined to the floor and wall assembly as shown in Figure 8.

- The completed module is then inspected by Quality Control and upon certification is loaded on a railcar for long distance shipment or moved to the site directly on the transporter. See Figure 9.

- The site foundation is prepared for the number of modules required for the floor plan.

- The modules, if shipped by rail, are removed from the railcar and placed on transporters and moved to the site.

- At the site the modules are lifted from the transporters to the foundation and assembled to each other as shown in Figure 10.

- The utilities are connected and earth is back filled against the grade beam as shown in Figure 11.

The system is now ready for occupancy.
Fig 1. Floor Element Ready for Assembly

Fig 2. Wall Elements Being Assembled on the Floor Element

Fig 3. Roof Element Being Assembled on the Wall Element

Fig 9. Complete Module ready for Shipment
Fig. Site Assembly of Modules

Fig. II Modules Assembled, Graded Connected to Utilities
THE MANAGEMENT TEAM

PRESIDENT

Joel Elman, formerly President of Litton Industries' Atherton Division. Joining Atherton as National Sales Manager in 1966, he advanced to Vice President and General Manager in 1967 and was appointed Division President in December of the same year. The Atherton Division is the largest manufacturer of microwave ovens and related equipment for the commercial food service industry.

Prior to joining Litton, Mr. Elman was, successively, a product research manager, field sales manager and division manager in a highly respected manufacturing company operating on a national scale.

Mr. Elman is a co-author of Computers and Small Manufacturers published in 1967 by Computer Research and Publications Associates.

During five years of military service, he commanded an airborne artillery battery, was captain and coach of the United States' Military Pentathlon Team and, as a member of the team, won the 1957 world high power rifle championship.

He received a B.A. with honors from Boston University and an M.B.A. degree from Harvard Business School where he specialized in marketing and corporate planning and was graduated in the top third of his class. He is 37.

VICE PRESIDENT AND GENERAL MANAGER

Bud Duft is a Civil Engineering graduate from the University of Texas and has done extensive graduate studies at UCLA in the areas of aerodynamics and thermodynamics. He holds a variety of patents in the utilization of composite material structural products and is the inventor of the MSC housing concept. Prior to founding MSC, he was Assistant to the Division Manager and Manager of Engineering for the Whittaker Corporation Research and Development Division. In this capacity he was a pioneer in the development of many innovations in the utilization of composite materials. He held this position for eight years.

Prior to this time he was Vice-President and General Manager of American Aerophysics Corporation, a Los Angeles based reinforced plastics manufacturing corporation. He was also a stockholder and director in that corporation. He also worked as Project Manager and Research Engineer for the Aerophysics Development Corporation and Northrop Aircraft. Significant contributions in these organizations included the development of the first Mach 7 research rocket in the United States and he was structures flight test coordinator for the F-89 aircraft. He is 39.
VICE PRESIDENT, SECRETARY AND TREASURER

William H. Kuntz, formerly Vice President, Secretary and Assistant Treasurer of Newell Industries Inc., a manufacturer of magnetic tape transports, recorders and recording systems for high speed video and instrumentation recording and digital recording for the computer industry.

For the preceding five years Mr. Kuntz was employed by Litton Industries in a variety of executive capacities most recent of which was Assistant Manager of Development Planning for the Corporate Professional Services and Industrial Services Group. Prior to that he was Assistant to the President of the Atherton Division of Litton Industries, the largest producer of microwave ovens for commercial food preparation. In this capacity, he was a co-founder of the division which was begun as a spin-off of Litton’s Electron Tube Division.

For the fourteen years prior, Mr. Kuntz was employed by the Automatic Canteen Company of America in a variety of engineering and management capacities; including Assistant to the Corporate Vice President of Manufacturing, Chief of Advanced Engineering Development for new products, Chief Applications Engineering with responsibility for technical administration of foreign licensees in all parts of the world, Applications Engineer and Development Engineer.

VICE PRESIDENT, ENGINEERING

Stephen I. Feher received a Bachelor of Science Degree in Aeronautical Engineering from West Virginia University and a Master of Science Degree in Engineering Sciences from the University of California (San Diego). Prior to joining MSC, he worked as a Design Engineer for the Boeing Company in Seattle and as Chief, Materials Engineering, for the Whittaker Research and Development Division. In this capacity, Mr. Feher served as Program Manager for Contracts for NASA, the Air Force and the Navy. He is 31.

MANAGER, DESIGN SECTION

Jere Robinson was formerly employed by Convair General Dynamics and joined the Research and Development Division of the Whittaker Corporation as Senior Research Engineer. In that position he supervised a number of composite design projects for aircraft systems. He holds a Bachelor of Science Degree in Mechanical Engineering from San Diego State College. He is 42.
MANAGER OF MANUFACTURING

Liberate Patag holds a Bachelor of Science degree in Aeronautical Engineering from the California Institute of Technology. His previous positions include the Angelus Aircraft Company, Eldon Fiberglass, the American Aerophysics Corporation, and Whittaker Research and Development Division where he served as Senior Process Engineer, and Manager of Quality Control. He has been engaged in process and product development on structural composites and reinforced plastic systems specifically designed for application over wide temperature ranges for over twenty years. He is 43.

CONTROLLER

William J. Hilliard, prior to joining the Company, was employed for six years with the Los Angeles office of a national firm of Certified Public Accountants. He received a Bachelor of Science degree in accounting from Los Angeles State College in 1963 and in 1965 became a Certified Public Accountant. He is 34.

CHIEF CHEMIST

Floyd D. Trischler has been affiliated with the Pennsylvania Industrial Chemical Corporation, Koppers Company, and the Research and Development Division of Whittaker Corporation where he served as Program Manager from 1963 to 1969. He was responsible for numerous advances in high-performance polymers, adhesives, coatings, composites and foams. He holds a Bachelor of Science Degree in Chemistry from the University of Pittsburgh and has done graduate work there and at San Diego State College. He is 40.
Subject: Transmittal of Request for Proposal No. H-55-69
"Operation BREAKTHROUGH--Application of Improved Housing Systems Concepts for Large Volume Production."

Gentlemen:

The Department of Housing and Urban Development is undertaking a new program, to be identified as Operation BREAKTHROUGH, to provide housing for people of all income levels, through a partnership of labor, consumers, private industry, and local, state and Federal Government, and bringing into play the use of modern techniques of production, marketing and management.

There is a demonstrated need and demand for housing throughout the country, especially quality housing for low- and moderate-income families. However, the market represented by this demand is fragmented, with each local element having different rules and requirements, both as to the type of housing required and the regulations under which this housing is produced. The housing industry, in response to this fragmented market, is itself fragmented into many local units, thereby foregoing many of the potential economies that could result from large-volume production methods.

For this reason, as one part of Operation BREAKTHROUGH, state and local bodies are being asked to identify and aggregate the housing market and locate specific land available for installation of the required housing. This Department is working with these authorities and will provide assistance in this effort.

As the second major part of this program, private industry is asked to provide the housing systems and construction concepts which can supply these aggregated markets with quality housing produced in volume, with costs controlled through utilization of economies of scale, efficient management and improvement in existing systems of production, construction, land use, and equity financing.

Two types of proposals will be accepted in carrying out this technical program. The first, identified in the Request for Proposal as Type A, will provide for the design, testing and evaluation, and prototype construction of complete housing systems which can lead to volume production.
The technical efforts in BREAKTHROUGH are planned to follow a series of phases, to provide proper program control. Briefly, these consist of Phase I, Design and Planning, Phase II, Prototype Construction, and Phase III, Volume Production; the total program plan is described in Attachment C to the Request for Proposal, and I suggest that this section should be read first.

Contracts will be awarded to those firms or consortia of firms proposing on Type A which demonstrate a capability for, and concept of, developing and producing housing in quantity, with resulting benefits, and will provide for Phase I and Phase II activities. Phase III contracts are expected to be negotiated between the successful contractors and the representatives (such as sponsors, private developers or housing authorities) of individual "aggregated markets." HUD will apply all available incentives and programs to assure the application of the concepts of organizations supported in Phases I and II to projects developed by the "aggregated markets." Organizations interested in responding to this part of the program (Type A) are invited to align themselves into teams or consortia which include all of the various disciplines required.

The second type of proposal, identified in the Request for Proposal as Type B, will be accepted for advanced research and development of ideas or concepts which are not ready for prototype construction or which provide individual elements of a total system. These concepts may include both "hardware" items and elements concerned with management, financing, site development, and processing. We solicit the creative and innovative capabilities of the entire American economy for such ideas, which can provide a basis for a continuing, long-term program to encourage, and where necessary, support such further advanced development. Where HUD considers it beneficial to the overall housing program objectives, separate contracts may be negotiated for this work.

We encourage organizations which have a capability in, and concepts available for, any of the individual elements mentioned, but do not have all the capabilities to do all the elements, to submit their ideas. In this case, the proposer should indicate his willingness to have the fact that he proposed a portion of the total effort made known generally so that other proposers may consider the desirability of matching their efforts with his to form teams. If the Government determines it is in its best interest to do so, it may accept proposals from such newly formed consortia after the required submittal date of proposals.

Finally, we recognize that the existing housing industry is capable of providing housing to a significant and increasing segment of the market through the market aggregation and financing activities we expect to result from BREAKTHROUGH activities. In addition, we look to this program to provide other, long-term benefits to all segments of the industry; among these benefits we see new and improved products and methods, improved management systems, and greater business opportunities through local franchising and contracting arrangements, improved code and code enforcement methods, etc.
We encourage those firms presently producing housing in quantity to review their designs, methods and markets to determine whether they could achieve significant improvements through the support provided in Operation BREAKTHROUGH.

Sincerely yours,

Harold B. Finger
Assistant Secretary
Operation BREAKTHROUGH, conceived less than a year ago, is, in the words of HUD Secretary George Romney, "a program designed to see just how cheaply we can build a house, but is a way to break through to total new systems of housing production, financing, marketing, management, and land use."

Twenty-two producers of housing systems will build their prototype models on Operation BREAKTHROUGH sites in 10 states. About 3,000 prototype housing units for various income levels will be built and evaluated at these sites.

More than 100 government experts in housing and related fields evaluated nearly 550 proposals by industry, local government, and individuals, for BREAKTHROUGH contracts for complete housing systems (Type A), prototype sites, and site planners. About 368 additional proposals (Type B) covering both "hardware" and "software" were then evaluated.

Construction is expected to start by early summer on the 10 prototype sites selected.

The 40-acre INDIANAPOLIS, IND., site owned by Marion County is on the periphery of the city near the Indianapolis Speedway and is part of a 160-acre tract of land.

The site located near HOUSTON, TEX., consists of 15 acres in Harris County, about three miles outside the city limits in the Clear Lake area.

The site located near JERSEY CITY, N.J., is a 15-acre site which overlooks a lake in Spring Valley Park.

The site located near SEATTLE, WASH., is a view of downtown Manhattan, 20 minutes away by rapid transit.

The Yeler-Atlantic Neighborhood Improvement Project in the downtown section of Seattle, and a plot of approximately 30 acres overlooking the SEATTLE, WASH., selected area is a combination consisting of about two acres in KALAMAZOO, MICH., and the West Avenue-Memphis, site in the Court Avenue renewal area downtown near the University of Tennessee Medical Center.

The SACRAMENTO, CALIF., site is approximately 60 acres occupying the eastern portion of the old California State Fairgrounds about four miles southwest of downtown.

The ST. LOUIS, MO., prototype site occupies two neighboring parcels of 7.6 acres and 7.9 acres in the Mill Creek urban renewal area downtown.

The site, approximately 30 acres of the 100 acres about five miles from downtown Wilmington, is an attractive pine-wooded estate with a six-acre lake.

Most of the selected producers will build their prototype housing units on at least two sites, and all sites will contain a variety of housing types and price levels.

When Operation BREAKTHROUGH is complete, HUD hopes to offer the housing industry evidence of a market sufficient to justify a large capital outlay. HUD is prepared to work with the housing industry to develop housing that the public will buy or rent readily; to display various types of relatively new and innovative housing employing the latest methods of industrialized production; to improve land use and development; to develop broader opportunities for financing and improved management; and to stimulate interest in greater local, regional, and even national markets for volume-produced housing.
MATERIAL SYSTEM'S application of sprayed fiberglass reinforcing and resin compounds simulates whatever shape and texture the factory forms create; therefore, buildings produced may have a wide range of design styles, from the most traditional to the most contemporary. Panels and other building elements are fabricated for single-family detached, single-family attached, and multi-family low-rise dwellings.

Material Systems Corporation is scheduled to construct a total of 110 composite material units on the checked sites.
STOCKHOLDERS

Shares authorized:

- common 1¢ par value: 1,500,000
- convertible preferred 5.1% voting 1¢ par value: 1,000,000

Shares outstanding:

- common: 512,000
- preferred: 900,000

SHAREHOLDERS

Development Technologies, Inc.1 248,428
Buddy L. Duft 66,667
Louis Marx Jr. 48,000
Joel Elman 24,190
U. S. Financial2 22,220
H. J. Heinz, III 19,846
New York Equities Co. 18,380
Alan R. Novak 14,195
Raymond A. Lamontagne 14,195
Michael L. Lehrman 14,195
Jan G. Deutsch 11,690
Stephen I. Feher 6,826
Samuel C. Butler 3,666

Total Outstanding Common Stock 512,500

---

1. A venture capital company all the common stock of which is owned by Louis Marx, Jr. and Daniel Lufkin and the preferred stock of which is owned by Pioneer Lands Corporation, a company owned by Messrs. Marx and Lufkin. Mr. Novak, the Chairman of the Board of Directors of the Company, is Chairman of the Board of Directors of Development Technologies, Inc., and Mr. Lamontagne, also a Director of the Company, is President and a Director of Development Technologies, Inc.

2. On conversion of 900,000 shares of preferred, USF will hold 272,220 shares of common.
THE BOARD OF DIRECTORS

Alan R. Novak, Chairman, has been a director of the Company since its founding in 1968. In addition, he is a private investor, attorney and Chairman of the Board of Development Technologies, Inc., a venture capital company. During 1968, he was director of the President's Task Force on Communications Policy. Prior to 1968, he was legislative assistant to Senator Edward M. Kennedy and Senior Special Assistant to former Undersecretary of State Eugene V. Rostow.

Joel Elman has been president of the Company since April, 1969. Previously, he was president of the Atherton Division (microwave ovens and related equipment) of Litton Industries with which he had been connected since 1966.

Buddy L. Duft, a civil engineer, has been a vice president of the Company since its founding in 1968. Prior thereto and since 1960, he was with the Research and Development Division of Whittaker Corporation (marine products) as Manager of Engineering and, prior thereto, assistant to the division manager.

Raymond A. Lamontagne has been associated with the Company since its founding in 1968. He is also an investor, an attorney and has been associated with John D. Rockefeller, III as senior counsel and associate for four years.

R. H. Walter is and has been president of U. S. Financial for more than five years. He and Messrs. John Halverson and Robert Stewart have served on the Board of Directors of the Company since December, 1969, and hold their directorship as nominees of U. S. Financial.
The Mod Squad
A New Kind of Housing Has Excited Washington and Wall Street

"We can build a house in a factory better than you can build one from the ground up on the site. It looks like a house, too. It's not a box or a shell or a trailer. Most developers have been sold on the idea, or can be. But we still have to make believers out of most of the public."

Robert C. Gennaro
President
United Research Homes, Inc.

Who's Who (Says HUD) in Modular Housing

Operation Breakthrough "Winners" (a)

- Aluminum Co. of America
- Ball Brothers (Borg-Warner)
- Boise Cascade Corp.
- Beck, Henry C. (Borg-Warner)
- Christiana Oil Corp.
- Descon-Concordia (Canada)
- Forest City Enterprises
- General Electric Co.
- Hercules, Inc.
- Home Building Corp.
- Kenee Corp. (Wickes)
- Modern General, Inc.
- Alpatec Corp.
- Bectel Corp.
- Development Cpl. of Amer.
- Dow Chemical Co.
- Housing Dev. Co. (Bldg. Systs.)
- Marlin-Marietta Corp.
- Omniform, Inc.

Operation Breakthrough "Losers" (b)

- Alodex Corp.
- Belchek Corp.
- Development Cpl. of Amer.
- Dow Chemical Co.
- Housing Dev. Co. (Bldg. Systs.)
- Marlin-Marietta Corp.
- Omniform, Inc.

The Also Rans: a Partial Listing

- Allied General, Inc.
- Alphatec Corp.
- Certain-Teed Products Corp.
- Commodore Corp.
- Electro-Mechanical Corp.
- Elecs, Cap. Corp. (Winston)
- HABITAT Group (Puerto Rico)
- Lockheed Aircraft Corp.
- Midland Co.
- Modular Comm. Devel. Inc.
- Modular Constructors
- Modular Homes Corp.
- Modular Housing Systems Inc.

(a) Team builders identified by prime contractor and/or leading member. 
(b) Among 37 proposals (of some 255 submitted) selected as finalists, 22 were chosen "winners", two were eliminated; the TRW Systems team entered two bids, winning one and losing one. 

Note: Companies (or teams) designated (x) have construction experience in mass housing, whether or not selected for Operation Breakthrough. Many other such companies elected not to submit proposals.
HOUSING: Hope Deferred

Ever since Housing and Urban Development Secretary George Romney unveiled plans for Operation Breakthrough last May, he has been promising with characteristic optimism that "this program is not a program designed to see just how cheaply we can build a house, but a way to break through to total new systems of housing construction." Last week, after months of planning and evangelizing, Romney set Operation Breakthrough in motion—but it was quickly apparent that instead of a quantum leap toward solving the nation's massive urban housing problem, about all that HUD could claim was a baby step.

At a press conference, Romney disclosed that he had selected 37 firms as "semifinalists" in a competition for twenty HUD contracts to build 1,500 mass-produced housing units in ten cities. But in sharp contrast to his earlier faith that the key to housing progress lies in technology, Romney conceded that any real breakthrough awaited the end of inflation and tight money—and a dramatic modernizing of antiquated local zoning and housing codes.

Even in technological terms, only a few of the proposals offered by the 37 competing firms were particularly exciting. About half of the entries, in fact, just used conventional concrete construction methods. As an official of one competing firm explained: "The big boys are not going to spend their research-and-development dollars without having hope for a real breakthrough in mass housing remains a distant dream. As one expert on Capitol Hill summed up at the weekend: "I still think that the program has gotten the attention of industry focused on better ways to build and sell houses. But it is asking too much to expect assembly-line, off-site production ideas at this time."

What new ideas were presented came from smaller firms such as Material Systems Inc., of Washington, D.C., which said it would mass-produce housing shells by spraying a combination of fiber-reinforced resin and dirt over molds.

Even more disheartening was the fact that the entries in HUD's competition offered little guidance on how to overcome the problems posed by local codes. These, along with foot-dragging by unions, have stalled any major innovative efforts. Said an official of the National Association of Home Builders: "We once managed to get a special permit and build a house with plastic plumbing in Knoxville, Tenn. But despite the fact that that house has been standing since 1960, plastic plumbing was written into the city code only two months ago. Getting changes is a very slow process."

HUD has consultants studying the code problem, and by late January, the agency will pick the twenty design finalists who will then build their pilot housing projects during 1970. Still, Romney's
3 Cities Selected as Sites Of Mass-Produced Homes

Jersey City Among Those to Get U.S. Aid
Under Nixon's Operation Breakthrough
—Experimental Materials Planned

By JACK ROSENTHAL
Special to The New York Times

WASHINGTON, Dec. 16—The first breakthrough in Operation Breakthrough was made today with the selection of eight cities, including Jersey City, as finalists for federally assisted prototypes of mass-produced housing.

Construction materials on these sites may vary from expanding concrete to sprayed resin and dirt. Prototype units will range from single-family homes to high-rise apartments.

About 1,500 prototype units, based on about 20 different system designs, are to be built at a potential Federal-private cost of $75-million.

Announcement of the first eight sites was made today by George Romney, Secretary of the Department of Housing and Urban Development.

The other sites are in Indianapolis; Kalamazoo, Mich.; Macon, Ga.; Memphis; Sacramento, Calif.; St. Louis and Wilmington, Del. Mr. Romney said two of the sites remain to be chosen, in Texas and the state of Washington.

The Jersey City site, consisting of 6.37 acres, is the smallest of the eight, which range up to 100 acres. All but one already are publicly owned.

Three of the sites are in central city areas, including the Jersey City site, which comprises about one-third of the St. John's urban renewal area, near Journal Square.

The site has a view of downtown Manhattan, 20 minutes away by rapid transit, and is adjacent to three new 21-story, middle-income residential buildings and a new library.

"Quite certainly, the Operation Breakthrough project will include high-rise buildings," Joseph Feinberg, executive director of the Jersey City Re-development Agency, said today. "But it might also involve some other kinds of new-technology construction."

Mr. Feinberg estimated the value of the now-vacant property at $250,000.

Aides to Mr. Romney said the breakthrough evident in the announcement today lay not in any single piece of technological wizardry, but in demonstrating the capacity of industry to develop industrialized housing.

They, like Secretary Romney, emphasized the role of Operation Breakthrough in overcoming obstacles other than technology, such as zoning, building codes, financing and management.

In addition to the selection of the sites from among 218 proposals, Mr. Romney announced the narrowing down of building system proposals from 236 to 37. About 20 systems will be chosen from these after further discussion and negotiation.

These are not futuristic proposals, some of which are being considered separately, but systems now ready for the broad-scale testing planned by the Department of Housing and Urban Development.

The 20 systems finally selected will be built on one or more of the 10 sites in varying combinations, depending on weather, population density and markets.

As he made his announcements today, Mr. Romney was flanked by large, sleek displays of 24 building system proposals. Among them was one, by the Bechtel Corporation of San Francisco, involving modules made of expanding concrete that provides its own pre-stressing and makes possible the use of thin elements.

Another proposal, by the Ma-

Continued From First Page, Second Section

8 CITIES SELECTED FOR HOUSING SITES

Continued on Page 44, Column 5
Law Will Speed Prefabs on Coast

SACRAMENTO, Calif. (AP) — Faced with the nation's biggest housing need, California is counting on a new law to speed up the state with low-cost, attractive homes that go from factory to family in a few days.

Members of the Pauma, Rincon and La Jolla Indian Reservations in San Diego County already are living in some of the homes.

A three-bedroom home of reinforced plastic costs $10,000 and is styled for Indian tastes, with plastic beams that look like wood, a plastic roof looking like red tile and a plastic door that looks like carved Spanish oak.

Builders say it will withstand earthquake and fire.

The crucial difference between the new housing and the old is that the new is built almost entirely in a factory and then assembled at the site in four or five days.

By mid-1970, state officials expect factories for prefabricated housing to be springing up throughout the state that has set a goal of three million new homes in the next decade.

They see it as the key to providing decent housing for Mexican-American farm workers in rural areas, low-income whites in suburbs and Negroes in big-city slums.

They point to a shortage of decent housing as a main contributor to ghetto unrest, and say a spinoff from the new technology will be employment of unskilled and semiskilled labor to construct the housing at the factories.

At present, builders say they can't afford to make such housing because conflicting local housing codes make it impossible to achieve substantial volume in prefabricated units.

The new law, which takes effect Jan. 1, in effect wipes out local codes for those who want to build at the factory. Inspection would be accomplished instead through a uniform, detailed state code that permits the housing to be checked at the factory by state inspectors. Local inspections would govern only on-site power hookups, water lines and so on.

Gov. Ronald Reagan says the bill "will not only help meet the ever-growing need for such housing by cutting through red tape and speeding the end product to the consumer, but it should also open up a new labor market, stimulate the economy and further develop space-age technology in the field of housing."

Robert T. Monagan, Republican Speaker of the State Assembly, cites a key reason why rapid expansion is expected in the field: it costs about $3 an hour or less for unskilled labor to put the houses together at the factory, compared with up to $10 an hour for skilled craftsmen at the site.

Promoters of the new law note that the main demand for housing—and the least supply—is in the vital $10,000-to-$20,000 area. Home suppliers can't afford to construct housing in this range at a price low-income purchasers can afford, they contend.

Law Will Allow Prefabs on Coast

Continued From Page 1
ON the small Rincon Indian reservation north of San Diego stands a brand new prototype house which ought to stir everyone concerned with the nation's headlong push toward a population of 300 million by the year 2,000.

To the naked eye, at a little distance, it looks like a conventional, even old-fashioned adobe ranch house with a Spanish-style red tile roof. Actually, it could help revolutionize the housing industry.

The big news about it is that it is the work of 12 aerospace engineers who were eager to show what could be done thru applying to the civilian scene some of the key technologies developed in pursuing the remarkable space program.

They have turned out a house that, as designed with three bedrooms and a two-stall garage, could sell for $10,000 if produced in substantial volume. If made somewhat more compact, it is estimated the selling price could be brought to around $6,000.

* * *

The prototype is almost wholly a thing of composite materials, principally fiber-glass and resins (for bonding). Resins are similarly used to bond metal surfaces in today's aircraft construction. They are also vital to the heat shield of the Apollo spacecraft.

Other engineers have looked at the Rincon model and pronounced it sound and durable, perhaps more resistant to California's occasional earthquakes than anything that could be built.

The new house is conventional in style because the Indian leaders were given their choice and that was it.

What the aerospace engineers have done is to simulate adobe, tile, wood and other surfaces which mask the fiber-glass composite. This reporter has seen the simulated surfaces and they have all the look of the real thing. Evidently the composite can be made to resemble any building or decorative material.

The Rincon experiment is a bellwether in the use of aerospace technologies in earthbound civilian realms. But in California other space engineers are trying to apply their techniques and modes of thinking to the problems of pollution, and there is one cluster of specialists prepared to apply space expertise to almost any imaginable earthly challenge.

* * *

THE 12 engineers who worked up the Rincon prototype got off and moving because two one-time Yale law school classmates, Ray Lamontagne and Alan Novak, were looking for a chance to implement programs in various fields that seem desperately to need what they call "development technologies."

They formed Material Systems Corporation, found a businessman, Joseph Elman, to head it, and put the 12 aerospace experts to work on the house problem.

Starting only last September, these men threw into the task their average 20 years' experience in space materials' breakthroughs. Their results clearly offer great promise.

Everything in the model is of composite except the core bathroom facilities. The company plans to erect soon a small factory on the Rincon reservation to prepare materials for further construction.

The word is getting about. A New York construction firm has placed an order for siding made of MSC's composite. Architects and others are traipsing to Rincon to study the prototype.

With overhead, start-up costs and the materials pioneering cranked in, the adobe house at Rincon actually cost $150,000. But Lamontagne and Novak, who have a varied background in public service, insist an ultimate selling-price range of $6,000 to $10,000 is reasonable for similar houses in standard production.

Whatever the future of this particular prototype, it is a ringing response to those who say space engineers cannot cut it in the earthbound world.
WOOD SUBSTITUTES URGED FOR HOUSING

Budget Director Robert P. Mayo believes it "would be desirable from a national standpoint to encourage the use of substitutes for softwood products, at least until an adequate supply of lumber is available."

Mayo, who is chairman of the President's task force on timber supply-lumber prices, made the comment in an address prepared for delivery Tuesday at Boca Raton, Fla., at the fall meeting of the National Forest Products Association.

He said task force studies indicate there will be a timber shortage for housing and other uses in the early 1970s and again after 1980 and he warned the producers that price response to these shortages could hasten wood substitutes.

According to Mayo, softwood requirements will increase from 50 billion board feet a year produced currently by as much as 6 to 8 billion board feet by 1973 and may reach 77 billion board feet by the year 2000.

Of the increased demand in the early 1970s, he said 2 billion board feet can come from Federal forests and a like amount from state and private holdings, still leaving a gap to be filled by substitutes and imports.

"The upward pressure of this residual gap on prices for softwood products," he added, "is likely to be significant during the years immediately ahead unless limitations on the availability of satisfactory substitutes, and institutional and legal barriers to their use, can be overcome."

Pointing out that prices generally respond when demand exceeds supply, he explained that it may be desirable to encourage wood substitutes.

He went on to say that industry should encourage private investment in timber production "if timber is not to be priced out of the long-term market by lower cost substitutes, developed in response to high prices for lumber and plywood."

The Budget director estimated that annual harvest can be increased 7-8 billion board feet over the next decade without impairing sustained yield or multiple use objectives, but he declared that "the quality of our environment and the proper utilization of our national resources must co-exist."

The task force chaired by Mayo made recommendations in April which resulted in relief from the timber shortage and high lumber cost crisis, and since then the Cabinet-level group has been working on long-term solutions.

He said the Administration "looks favorably" on the basic policy objections of pending legislation to improve lumber management but is opposed to earmarking timber receipts for development of timber resources because "the earmarking of any funds serves to foreclose the President's budget options in the years ahead."
Material System Corporation
CONSOLIDATED BALANCE SHEET
July 31, 1970

<table>
<thead>
<tr>
<th>ASSETS</th>
<th></th>
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<tbody>
<tr>
<td>CURRENT ASSETS</td>
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<td></td>
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<tr>
<td>Cash</td>
<td>$58,714</td>
<td></td>
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<tr>
<td>Accounts receivable</td>
<td>14,716</td>
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<tr>
<td>Raw materials inventory</td>
<td>14,785</td>
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<tr>
<td>Prepaid expenses</td>
<td>16,861</td>
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<tr>
<td>Total current assets</td>
<td>105,076</td>
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<tr>
<td>PLANT AND EQUIPMENT (NOTE B)</td>
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<tr>
<td>Leasehold improvements</td>
<td>$71,020</td>
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<tr>
<td>Machinery and equipment</td>
<td>72,118</td>
<td>143,138</td>
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<tr>
<td>Less accumulated depreciation</td>
<td>10,368</td>
<td>132,770</td>
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<td>OTHER ASSETS</td>
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<td>Unrecovered development costs (NOTE C)</td>
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<td>Long term note receivable</td>
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<td>Unamortized organization costs</td>
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<tr>
<td>Deposits</td>
<td>975</td>
<td>957,216</td>
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<td>$1,195,062</td>
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<tr>
<td>CURRENT LIABILITIES</td>
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<tr>
<td>9.5% notes payable - unsecured</td>
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<tr>
<td>Accounts payable</td>
<td>157,110</td>
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<tr>
<td>Equipment purchase contracts</td>
<td>17,654</td>
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<td>Accrued payroll</td>
<td>10,420</td>
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<td>Accrued interest</td>
<td>4,325</td>
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<td>HUD progress billings, less accumulated costs of $30,515</td>
<td>1,901</td>
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<tr>
<td>Total current liabilities</td>
<td>491,410</td>
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<tr>
<td>MINORITY INTEREST IN SUBSIDIARY</td>
<td>4,500</td>
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<td>STOCKHOLDERS' EQUITY</td>
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<td>Capital stock (NOTE D)</td>
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<tr>
<td>Preferred</td>
<td>$500,000</td>
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<tr>
<td>Common</td>
<td>300,000</td>
<td>800,000</td>
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<tr>
<td>Less deficit in retained earnings (NOTE E)</td>
<td>100,848</td>
<td>699,152</td>
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<tr>
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<td>$1,195,062</td>
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</tbody>
</table>

See the accompanying notes to consolidated balance sheet
NOTE A - PRINCIPLES OF CONSOLIDATION

The accompanying consolidated balance sheet includes the accounts of the company and its two subsidiaries (95% owned Material Systems Southwest Corporation and wholly owned International Material Systems Corporation). All significant intercompany items have been eliminated.

NOTE B - PLANT AND EQUIPMENT

Plant and equipment are stated at cost for purchased assets and at the lower of cost or estimated market value for assets constructed by the company. At July 31, 1970 they comprised and are depreciated over useful lives as follows:

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
<th>Useful lives</th>
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<tr>
<td>Office building (prototype house)</td>
<td>$9,900</td>
<td>10 years</td>
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<tr>
<td>Machinery and equipment</td>
<td>47,916</td>
<td>5 to 10 years</td>
</tr>
<tr>
<td>Office furniture and equipment</td>
<td>8,508</td>
<td>5 to 10 years</td>
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<tr>
<td>Vehicles</td>
<td>5,794</td>
<td>4 years</td>
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<tr>
<td>Leasehold improvements</td>
<td>71,020</td>
<td>Remaining lease term</td>
</tr>
<tr>
<td></td>
<td>143,138</td>
<td></td>
</tr>
</tbody>
</table>

Less - Accumulated depreciation     | 10,368  |
                                         | $132,770|

NOTE C - UNRECOVERED PROMOTIONAL AND DEVELOPMENT COSTS

The company was organized primarily for the purpose of developing, manufacturing and marketing factory produced, low cost housing utilizing composite material technology. Because the company is in the developmental stage, all costs relating to the promotion and development of its products are being deferred for book as well as tax purposes until significant production begins, at which time such costs will be amortized over an estimated 60-month period.

Promotional and development costs include (1) cost of developing the required technology, (2) cost of designing and constructing composite material tooling, (3) cost of constructing the prototype house (less $9,900 estimated market value included in fixed assets) and (4) other general and administrative costs.
A summary of unrecovered promotional and development costs from date of incorporation to July 31, 1970 is as follows:

Salaries and wages $385,341
Materials and supplies 211,359
Professional fees 108,432
Outside services 32,695
Travel and entertainment 33,487
Rent 29,040
Utilities 22,463
Payroll and other taxes 23,064
Office expense 19,112
Insurance 18,001
Depreciation 10,368
Advertising 8,862
Interest 6,873
Maintenance 3,389
Miscellaneous 13,316

$925,802

NOTE D - CAPITAL STOCK

At July 31, 1970 the capital stock of the company was as follows:

5.1% cumulative preferred stock - authorized 2,100,000 shares of $1.00 par value; issued and outstanding 900,000 shares $900,000
Less discount on par value 400,000
500,000

Common stock - authorized, 1,000,000 shares of no par value; issued and outstanding 512,500 shares 300,000

$800,000

The preferred stock may be redeemed by the company for an aggregate of $900,000 cash on or before July 1, 1983 or at the option of the holder the shares of preferred stock may be converted into a maximum of 250,000 shares of the company's no par value common stock.

During August, 1970 the company was reorganized in Delaware and the following changes in capital stock occurred; the preferred stock became 1,000,000 authorized shares of 1¢ par value; the common stock became 1,500,000 authorized shares of 1¢ par value. No changes occurred in the number of shares outstanding.
NOTE E - DEFICIT IN RETAINED EARNINGS

The company's wholly owned subsidiary, International Material Systems Corporation, was organized primarily to develop and refine aerospace-oriented advanced composite materials technology. In September 1969, the aerospace activities of the company were terminated and the equipment related to those activities was later sold for its book value of $7,346 to a former officer of the company. In connection with the aerospace effort, the company incurred total expenses of $135,784. The company no longer intends to engage in aerospace activities and, accordingly, the excess ($85,298) of such expenses over sales of aerospace-oriented products has been charged to deficit in retained earnings.

Additionally, corporate reorganization expenses totaling $15,550, incurred when the company was reincorporated in California, have been charged to deficit in retained earnings.
<table>
<thead>
<tr>
<th>Date</th>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
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</tbody>
</table>

**Material Systems Corporation**

**Projected Cash Receipts and Disbursements**

**September 1970 Through August 1971**

<table>
<thead>
<tr>
<th>Month</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
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</tr>
</tbody>
</table>

**Cash Reconciliation**

<table>
<thead>
<tr>
<th>Category</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tbody>
</table>

**Bank Reconciliation**

<table>
<thead>
<tr>
<th>Bank</th>
<th>Balance</th>
<th>Deposits</th>
<th>Withdrawals</th>
<th>Balance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Other**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

**Notes**

- Please review the statement for any discrepancies.
- Any adjustments should be noted in the comments section.
MATERIAL SYSTEMS CORPORATION

PROJECTED CASH RECEIPTS & DISBURSEMENTS
September, 1970 through August 1972

ASSUMPTIONS:

1. Assumes build up to two plants, operating 3 shifts each, producing a total of 100 units per month.

2. Assumes selling price on commercial sales of $10,000 per unit.

3. Assumes cost plus fixed fee contract on units produced for HUD Phase II.

4. Royalties from joint ventures/franchises assumed to be 5% of sales.

5. Royalties from foreign operations assumed to be 5% of sales.

6. Selling/G&A expense includes minimum expenses associated with lease obligations of Rincon Facility.
MATERIAL SYSTEMS CORPORATION

PROJECTED ECONOMICS OF OPERATING A SELF-CONTAINED COMPOSITE MATERIAL HOUSING MANUFACTURING PLANT

Investment:

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product tooling</td>
<td>$145,000</td>
</tr>
<tr>
<td>Production tooling</td>
<td>275,000</td>
</tr>
<tr>
<td>Working capital</td>
<td>300,000</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$720,000</strong></td>
</tr>
</tbody>
</table>

Plant Capacity: 50 units/mo @ 3 shifts

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selling price/unit</td>
<td>$10,000</td>
</tr>
<tr>
<td>Unit cost @ capacity</td>
<td>(6,000)</td>
</tr>
<tr>
<td>Average transp. cost/unit</td>
<td>(500)</td>
</tr>
<tr>
<td><strong>GROSS REVENUE</strong></td>
<td><strong>$3,500 X 50 units/mo = $175,000</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burden</td>
<td>$24,700</td>
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<tr>
<td>Depreciation</td>
<td>84,000</td>
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<tr>
<td>Lease expenses</td>
<td>5,125</td>
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<tr>
<td>Selling &amp; G&amp;A expenses</td>
<td>23,100</td>
</tr>
<tr>
<td><strong>(136,925)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>PROFIT/MONTH</strong></td>
<td><strong>$38,075</strong></td>
</tr>
<tr>
<td><strong>ANNUAL PROFIT.</strong></td>
<td><strong>$456,900</strong></td>
</tr>
<tr>
<td><strong>ANNUAL ROI</strong></td>
<td><strong>63.5%</strong></td>
</tr>
</tbody>
</table>
August 18, 1970

Mr. Robert O. Figueredo
Caracas, Venezuela

Dear Mr. Figueredo:

You and your associates have held various conferences with representatives of Material Systems Corporation ("MSC"), have examined a confidential business memorandum prepared by its management, including drafts of its financial statements as at May 31, 1970, have visited its offices and facilities, and have reviewed generally its business and operations. As a result, you have determined, and hereby agree, to make a direct equity investment in MSC by the purchase for investment and not with a view to public distribution on August 31, 1970 (or any day within seven days thereafter chosen by you in a written or telegraphic notice to MSC on or prior to August 25, 1970) of 38,461 shares of MSC Common Stock for an aggregate cash purchase price of US$250,000 (approximately $6.50 per share), and MSC hereby agrees to sell you such shares on such date (subject only to approval of its Board of Directors to be obtained by August 31, 1970). Such purchase shall be for your account or for the account of a corporation (which may use the name "Material Systems" and is herein referred to as "NV") to be formed by you and/or for the account of not more than a limited group of your close associates. Certain other arrangements have been discussed with respect to the obtaining by NV of a license to manufacture and sell in Latin America and the Spanish speaking areas of the Caribbean the building system and related components (such as siding, roofing, doors, etc., for all purposes including residential and industrial construction) developed by MSC. This letter will further confirm the understandings which have been reached on these matters.
1. MSC hereby grants to you the option to purchase from MSC for your own account or for the account of NV and/or not more than a limited group of your close associates (subject only to approval of the MSC Board of Directors to be obtained by August 31, 1970), for investment and not with a view to public distribution, a total of 236,539 shares of Common Stock of MSC on the dates and at the cash purchase prices set forth below:

   (a) On September 30, 1970, 48,275 shares of Common Stock at an aggregate price of US$350,000 (approximately $7.25 per share);

   (b) On October 31, 1970, 72,000 shares of Common Stock at an aggregate price of US$450,000 ($6.25 per share); and

   (c) On November 30, 1970, 116,264 shares of Common Stock at an aggregate price of US$641,250 (approximately $5.52 per share).

You may, without penalty, postpone any purchase date for up to seven days by written or telegraphic notice to MSC at least five business days prior to the scheduled purchase date.

2. All purchases pursuant to this agreement shall take place at the offices of Stroock & Stroock & Lavan, 61 Broadway, New York, New York, and payment shall be made by certified or bank check payable to the order of MSC. The shares purchased shall be duly authorized, validly issued, fully paid and non-assessable, and an opinion of counsel confirming such status shall be delivered to you, together with the certificates for the shares, registered in such names as you shall have designated, as soon as practicable thereafter.

3. MSC warrants to you that it has outstanding a total of 512,500 shares of Common Stock and 900,000 shares of $1.00 par value Preferred Stock, which shares of Preferred Stock are convertible into an aggregate of 250,000 shares of Common Stock, plus options and warrants to purchase up to an additional 50,000 shares of Common Stock, and will have the same capitalization (modified only
by conversions, option exercises and issuance of shares hereunder) outstanding on each purchase date.

4. MSC contemplates that prior to August 31, 1970 it will reincorporate as a Delaware corporation with the same assets and liabilities as the existing California corporation. Each shareholder of MSC will thereupon own one share of stock of MSC-Delaware for each share of stock of MSC theretofore owned. In this connection, it is expected that the shares to be purchased and sold hereunder shall be shares of MSC-Delaware and you consent to the reincorporation in Delaware.

5. Promptly after completion of all the purchases pursuant to the option granted in Paragraph 1 hereof, MSC will elect a representative of the holders of the shares sold hereunder to its Board of Directors. When MSC shall register under the Securities Act of 1933 for resale to the public the shares of Common Stock held by any of its principal stockholders, it shall at the request of the holders of the shares sold hereunder include therein such of the shares sold hereunder as they shall request, without cost to them.

6. Promptly after the completion of all the purchases pursuant to the option contained in Paragraph 1 the parties shall enter into a long term exclusive license and technical assistance agreement between MSC and NV, pursuant to which MSC will license NV to produce and sell all MSC's composite materials building systems and related components (such as siding, roofing, doors, etc., for all purposes including residential and industrial construction) throughout Latin America and the Spanish speaking areas of the Caribbean, MSC will render required technical assistance to NV, MSC will receive royalties and other compensation from NV, all on terms to be mutually agreed between the parties and as provided in Paragraph 7 hereof.

7. The license agreement shall cover all patents, patent applications, know-how and other technical information owned by MSC or which it is entitled to license, all of which shall be subject to appropriate secrecy undertakings, and shall
include provisions for the reciprocal licensing of improvements and the continued exchange of current data. The license in each country shall be on terms and conditions to be agreed upon, including minimum royalties and other performance tests, and in the event MSC and IV are unable to agree, on a country by country basis, upon the terms and conditions of any license, the license shall be on terms and conditions no less favorable to MSC than may be obtained by MSC from time to time from any bona fide third party offeror.

If the foregoing correctly sets forth our agreement, please confirm by signing and returning to us the enclosed copy of this letter.

Very truly yours,

MATERIAL SYSTEMS CORPORATION

By

Alan R. Novak, Chairman of the Board

AGREED TO AND ACCEPTED:

Robert O. Figueroa