



THE DOW CHEMICAL COMPANY

MIDLAND, MICHIGAN

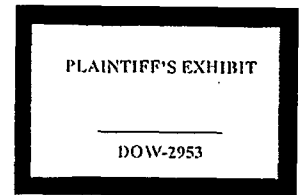
February 19, 1970

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Sources Sought Clip File
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Air Force Special Weapons Center
Procurement Division, Attn: SWMKB
Kirtland Air Force Base
New Mexico 87117

GFA



Reference: R&D Number 17

Gentlemen:

Subject: Development of a Family of Lightweight, Portable
Shelters

This letter is submitted in response to the subject solicitation Research and Development Sources Sought, in the Commerce Business Daily, Issue No. PSA 5002 dated February 12, 1970. It is intended that this letter establish the capability of The Dow Chemical Company in the subject area. We request that we be placed on the Bidder's List to receive requests for proposals in the subject area of work.

I. Company Background

The Dow Chemical Company ranks fourth in chemical production in the United States and manufactures more than 700 products. The record shows that the Company has had one of the most rapid growths in the chemical industry, having over a ten-fold increase in sales since 1945. Current sales are running at approximately 1.8 billion dollars annually. The line of products manufactured by Dow includes chemicals, plastics, bioproducts, metals, packaging and consumer products.

The Company operates four large chemical complexes located in Midland, Michigan; Freeport, Texas; Pittsburg, California; and Plaquemine, Louisiana. Smaller chemical production units are located elsewhere. Total employment in the United States is over 34,000. The Midland location of The Dow Chemical Company has been cleared SECRET by the Fifth Army, Chicago, Illinois, and has a facilities Contract No. AF 33(657)-12182.

The Company has over 3,700 employees engaged in research, staffing 70 research laboratories in 13 different locations.

Over 40 branches of science and engineering are represented. Most of the facilities, some 40 laboratories, are in Midland, Michigan, the Company headquarters.

During 1968, Dow was granted 490 U. S. patents and 1,043 foreign patents. At the year's end, the Company held 5,284 U. S. and 7,844 foreign active patents.

A. Construction Materials Research

The Dow Chemical Company has been involved in research in materials of construction since its very beginning. Responsibility for construction materials research has been in many areas within the Company--production, shops and services, engineering, research, etc. The Construction Materials Research group was established a number of years ago as a part of the Polymer Research Laboratory to do product application research. The disciplines of civil, mechanical, and chemical engineering which are required for construction projects are all represented. The group is under the direction of D. L. Graham, Technical Manager of Construction Materials Research and Development for the Functional Products and Systems Department.

The group has been responsible for the research and development of insulating materials and construction details for roofs, walls, perimeters and floors for buildings, particularly low temperature warehouses; highway insulation to prevent frost heaving; sandwich construction and adhesives. However, their main emphasis has been toward total systems concepts for building, housing, and containers. The development of Spiral Generation, an automated method of producing shell structures, from laboratory scale to field production of structures up to 170 feet in diameter. This project required the fabrication of completely portable production units having all necessary auxiliary tools and equipment together with trained crews.

Another major area of research work concerns the development of construction and fabrication concepts utilizing plastic, metal and wood materials. This wide range of projects has involved structural analysis of rigid frames, sandwich panels, and monocoque shells.

B. Plastic Foam

Dow has paced the chemical industry in the development of plastic materials. Closely following the polymer developments have been the foamed plastics which were first made and used as flotation, novelty and decorative materials. Styrofoam" brand expanded polystyrene began to be marketed in 1945. Cork was in very short

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supply during and immediately after World War II and had been traditionally used for insulating cold storage warehouses. It was soon displaced by Styrofoam in that market.

The rigid polystyrene foam was very stable and not affected by water. The closed cells of polystyrene did not absorb water and resisted the passage of all but extremely small amounts of water vapor. Practical performance was not degraded and today the billets are extensively used for marina flotation.

While working with the material, its distinctive structural properties became evident. The compressive strength is adequate to support concrete floors with heavy fork truck traffic. High density Styrofoam (up to 4.5#/ft.³) is used to support and insulate the steel building columns in cold storage warehouses.

C. Sandwich Construction

Light weight rigid plastic foams, particularly Styrofoam, have properties suitable for the core of sandwich panels. Thin, high strength faces bonded to light, rigid foam cores possess unusually high structural properties per unit weight of element. The aircraft industry has long employed sandwich panels with aluminum honeycomb cores to obtain favorable strength/weight ratios. The low density core serves to position the skins and prevent face buckling. The faces then perform in tension or compression similar to the flanges of an "I" beam which are spaced by the web. Dow is now marketing a line of plastic foam core panels having plywood, plastic, and metal facings.

Extensive experimentation has been done with all varieties of facings including metals, fiberglass reinforced plastic resin, cement asbestos board and others. Experimentation is continually performed on new types of core configurations and core-skin combinations. This effort encompasses structural systems concepts and spatial configurations. Recently a complex of three research buildings, two based on load bearing sandwich panels and the third a Spirally Generated elliptical shell, were completed by the group at the Purdue University experimental farm, Lafayette, Indiana. At the present time, the panels are commercial sales items and pre-engineered buildings based upon the research structures are under development.

As a result of the involvement in sandwich panel technology, a line of air cargo containers has been developed. The smaller sizes have been used mainly for refrigerated or controlled condition cargoes, since the sandwich panel with cellular plastic cores inherently provides thermal insulation. These concepts have been expanded to include larger air cargo structures in which the superior rigidity and light weight of sandwich panels are very effective.

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In 1964 and 1965, a number of prototype air cargo containers, for both military and commercial airline use were engineered, fabricated, and tested. These included modular size units for less than pallet loads and "Master Size" units for loads which utilize the full 88" x 108" pallet position. The Air Force has approximately 135 of these in service presently.

Work has continued in this area to evolve basic cargo container products for both military and commercial requirements. At the present time research and development activities are in progress for the design and fabrication of an 8' x 8' x 20' air cargo container prototype.

A continuing effort has been made to evaluate new materials and composites. Special emphasis has been made to develop data during these testing programs to support the activities in the air cargo container area.

A manufacturing plant was established in 1967 at Cape Girardeau, Missouri to product sandwich panels for the construction industry. The plant has been operating continuously since that date and plants are being implimented for expanding its capacity.

D. Spiral Generation

This process was originated in 1960 by personnel now in the Construction Materials Laboratory. The process continuously heat welds sections of thermoplastic Styrofoam[®] expanded polystyrene together to form a cellular plastic shell. The shape of the shell is controlled by the supporting boom mechanism to form general shapes ranging from hemispherical domes to varying smooth curves. These range from an auditorium to a cluster of shells for a clinic. Research and development of this conventional process has continued and wire reinforced cellular plastic shells with elliptical caps and short vertical walls are now being erected commercially.

The Spiral Generation process using Styrofoam" produces shell section at the rate of 20 lineal feet per minute. A three-man crew with present equipment can produce an 80-foot diameter, low profile shell of 18.6 feet height with an 8-inch thick wall in less than 12 hours continuous operation.

The possibilities of generating walled structures and shells with rigid foam-in-place materials is being explored. This activity was motivated by the obvious logistic advantages of foam-in-place materials and the ability of the reactive resin systems to simultaneously adhere reinforcing skin materials. The recent research work has demonstrated the feasibility of continuously forming highly reactive, rigid, flame retardant urethane foams. A modest amount of research work on this process has been funded by the U. S. Army Mobility Research and Development Center under Contract DAAK02-69-C-0569 which is due to be completed in April 1970. Follow-on work has been proposed but has not been fund

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The skin membranes produce a substantial increase in shell strength properties. Preliminary experience with rigid polyvinyl chloride plastic sheet show that the full strength of the material can be effectively utilized.

The Spiral Generation technique through the use of foam-in-place cellular plastics and sandwich design theory has finally made possible the advantages promised by true surface structures. The concept of spirally generated structures in its broadest sense is the rapid, continuous, automatic joining of materials to form an essentially two dimensional surface without temporary supports by a generating head whose motion is controlled through predetermined movements of a variable length boom. The concept includes many materials, surface shapes, and wall cross section designs. Because of this inherent flexibility, it can be used to provide a variety of buildings from free span helicopter shelters or hangars to field hospitals.

A critical material requirement which stems from the advantage of speedy erection and the elimination of temporary forms is that the materials being joined together must continuously bond with that of the previous pass and maintain their designed shape within a time period of 10 to 20 seconds.

To achieve the desired speed, thermal fusing or very reactive chemical resins foam-in-place chemicals have been utilized. Thermal welding of thermoplastic cellular materials is presently the major technique used in commercial operations.

Two brochures are attached to this response. "Spiral Generation" portrays a number of structural concepts and illustrates now obsolete equipment. "Dow Domes" describes present activities in environmental enclosures.

F. Engineering and Construction Services

This group provides engineering and construction service for the Company world-wide. Branches are maintained in locations appropriate to the demands of the local area. Midland, Michigan, and Houston, Texas, have major offices. Plant and equipment design are part of the service provided and it operates with the various Dow Divisions and Departments much the same as in independent consulting engineering firm operates with clients.

II. Personnel

Since Dow has such a large number of scientists, it cannot be determined in advance which of them will be assigned to any research and development project until the specifics of the work are defined. At that time, the educational, scientific,

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and managerial experience of the personnel who will be assigned will be matched with the research requirements of the project. However, for the area of construction systems, certain engineers may be assigned as principal investigators. The personnel resumes of these individuals are attached.

III. Facilities

The Midland location of The Dow Chemical Company has laboratory space, testing equipment, shop fabrication, engineering support and all the miscellaneous facilities required to support a shelter development program.

The Dow Chemical Company has had a number of submissions of both Sources Sought Responses and proposals to Kirtland Air Force Base within the past two years. It may be helpful to mention the following:

R&D #54, 23 May 1969, Materials and Techniques for Permanent Arctic Construction

R&D #90, 23 Sept. 1969, Temporary or Permanent Solutions to Corrosion Problems

R&D #81, 20 Aug. 1969, Concept for a Structural Module

R&D #55, 23 May, 1969, Effects of Urea and Other Ice Control Agents on Pavements

R&D #93, 15 Oct., 1968, Use/Effects of Chemicals on In Situ Soils

R&D #38, 15 Apr., 1969, Index System for Soil Stabilization

R&D #83, 6 Sept. 1968, Explosives Development Program

R&D #86, 1 Sept. 1967, Soil Stabilization

Dow Proposal No. 568454 submitted in response to RFP No. F29601-68-R-0110

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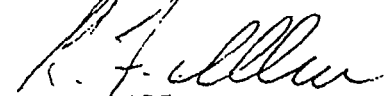
Kirtland AFB

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We believe that Dow has a comprehensive development organization, which has the capabilities required for the development of a family of lightweight, portable shelters.

Very truly yours,



G. F. Allen
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566 Building
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Att.

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