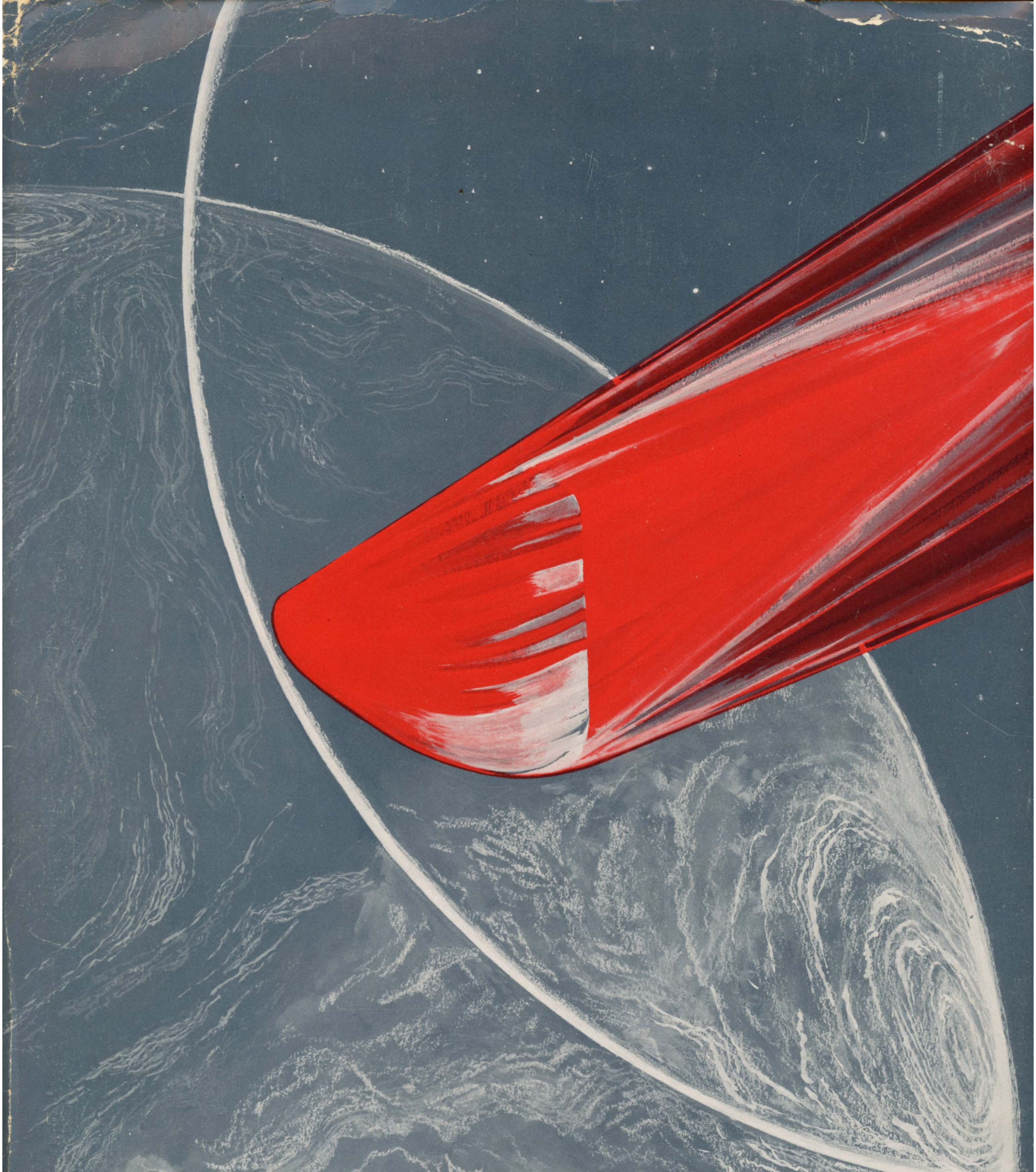

D.E.N. 438...
A Safe Ride Home For Apollo 11

DOW®

DOW DIAMOND

June 1969

Moon Mission: A Child's View

Dow DIAMOND
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IN THIS ISSUE

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ON THE COVER: As the Apollo 8 astronauts came around the far side of the moon last December, they were greeted by the beautiful sight of the Earth. Then Apollo 10 made a moon trip in May. Now comes Apollo 11, the most important of them all, the lunar landing mission. Back on earth, people of all ages have their ideas about the moon landing—even to sketching their impressions. Read the feature beginning on page 1 to see how some children view this momentus occasion.

ART AND DESIGN: PARKER, WILLOX, FAIRCHILD & CAMPBELL
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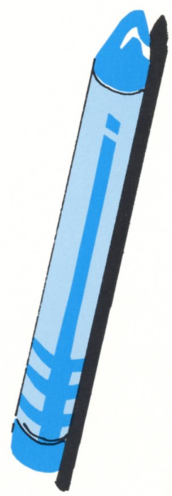
Moon Views from Earth



THE MOMENTOUS OCCASION should take place at 2:19 p.m. (EDT) on Sunday, July 20. It's that precise.

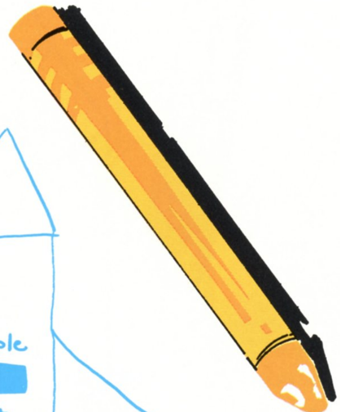
Astronauts Neil Armstrong and Edwin E. Aldrin, Jr. are scheduled to make the moon touchdown and with it will come one of history's greatest accomplishments.

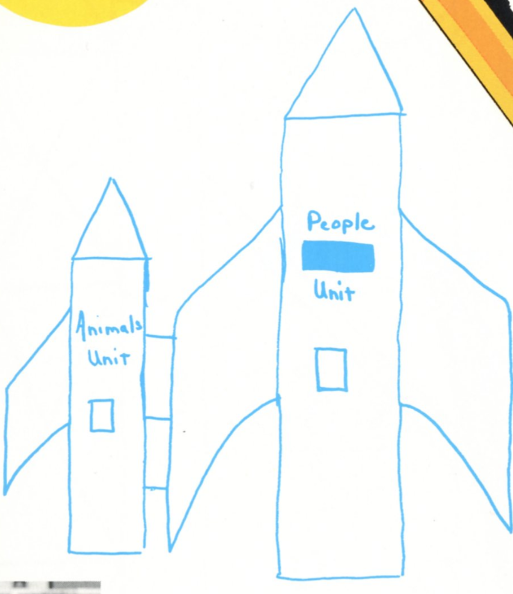
Since its start the Apollo mission has pointed toward this event. The most decisive test to date came during the Apollo 10 flight which blasted off from Cape Kennedy on May 18. Gathered from the flight were the answers to two vital questions: is it safe to land on the area selected for the landing; will the lunar module slow down enough for a "soft" landing?

If the Apollo 11 mission is launched on schedule to meet the July 20 rendezvous with history, the culmination of America's space efforts will have been reached.

Meanwhile, back on earth, the moon mission has a variety of meanings to school children. Youngsters at Chestnut Hill Elementary School in Midland, Michigan recently drew their impressions and wrote their observations about landing on the moon.

On these pages you will read how children between the ages of seven and 12 feel about the moon mission.





Why I Wouldn't Like To Live on the Moon

I don't think I would like to live on the moon because I would have to wear an air helmet and a big suit to keep me warm enough. And If I had to go and live on the moon it wouldn't be very pleasant because there would be no sunshine and there wouldn't be any swimming or growing trees and flowers.

Also, if they just took people from different cities you might have to leave some of your friends. You also would probably have to leave your animals behind because you couldn't take a lot of animals in a spacecraft to the moon and make them wear spacesuits.

Kelly Sheahan
6th

Living On The Moon

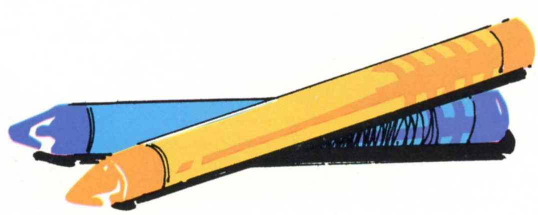
I lived on the moon in a crater. When I ate dinner, I kept floating up in the air and so did my plate. When I went to bed I couldn't sleep because my bed kept floating.

Then one day my daddy tried to put a roof over the crater. It worked, but it would not stay on. Then he put nails to make it stay down. I could play a little, but I would start floating sometimes. My friend had a funny house because it kept floating.

My other friend had a farm and her barn kept floating, but her plants, I guess they stay right where they were.

THE END

by Lori Lynn Guy
second grade



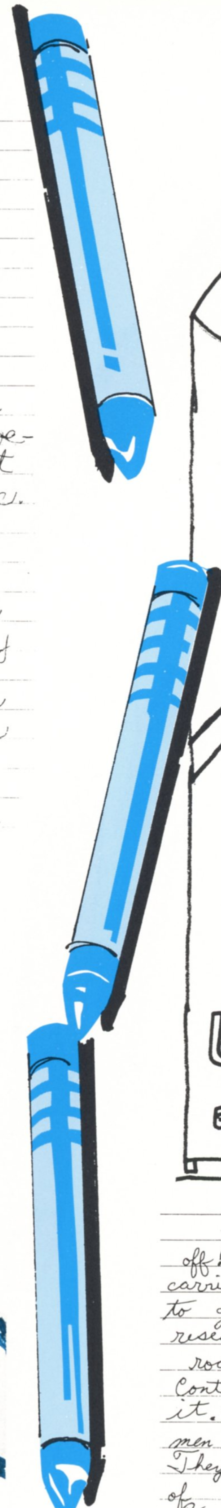
I Wish We Could Go to the Moon

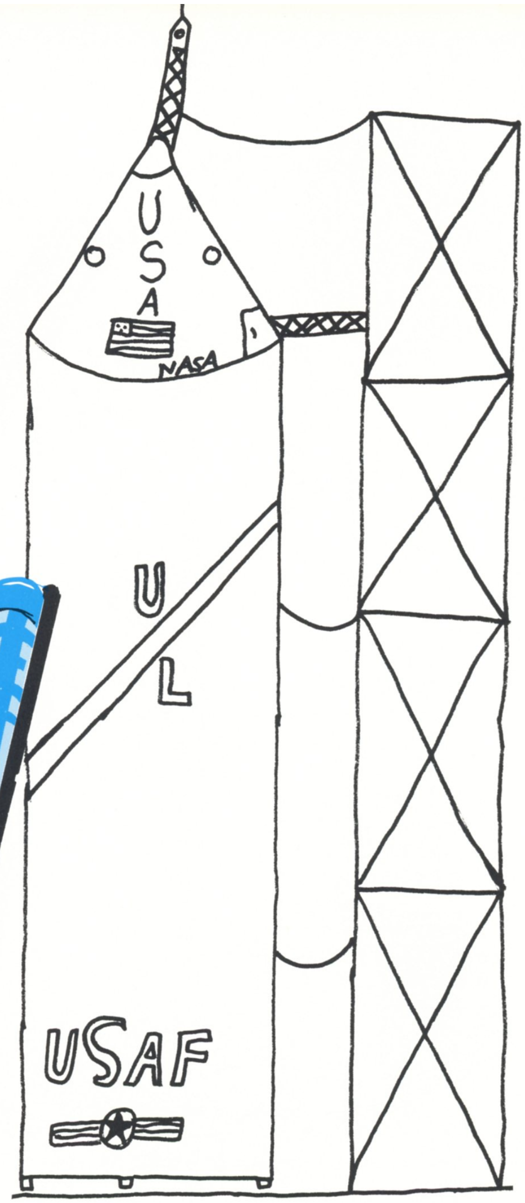
I wish we could go to the moon. It would be lots of fun. The homes that we would live in would be in the craters. The stores and buildings would be in the biggest craters.

To get to the moon instead of a rocket there would be moving stairs. It would take about five hours or more to get there. The moving stairs are real fast. It goes about 200 miles an hour or over.

We could get electricity from earth by long, long cords. They would be coming up the side of the moving stairs. Then we could have refrigeraters and other things that use electricity.

Susan Little
Grade 4

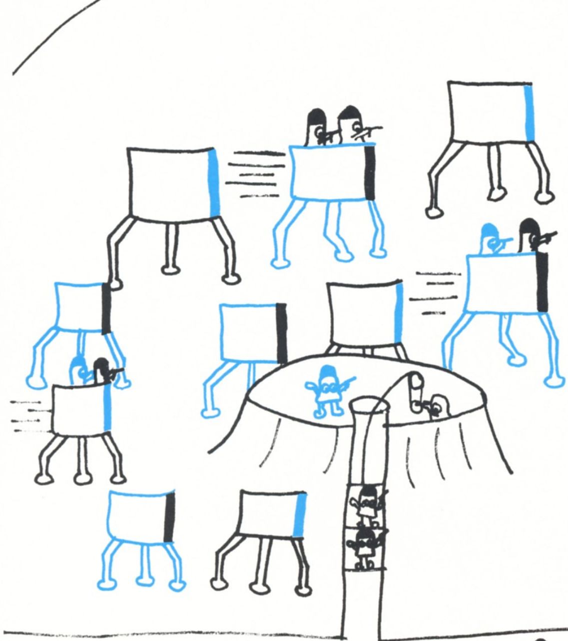




Five.. four.. three.. two.. one.. blast off!! The ship is on its way. It carries three astronauts whose mission is to go to the moon, conduct scientific research, and return to Earth. As the rocket ascends, the men in NASA Control think about the workmanship in it. Months of it. In a week, these men shall land on the moon's surface. They work for the betterment of man's knowledge of space. Hardships might come, but these men take the risk for the United States.

Ric Shahin
6th

What Life Could Look Like on the Moon

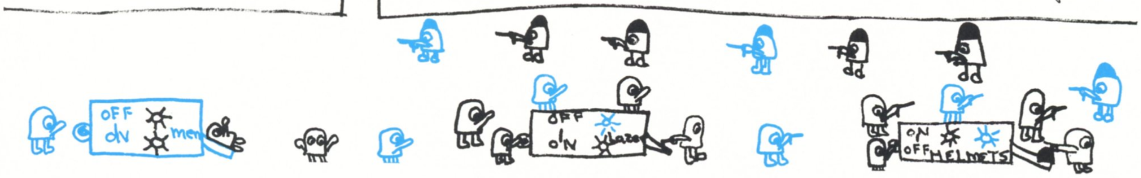


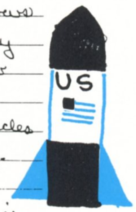
Life on the Moon

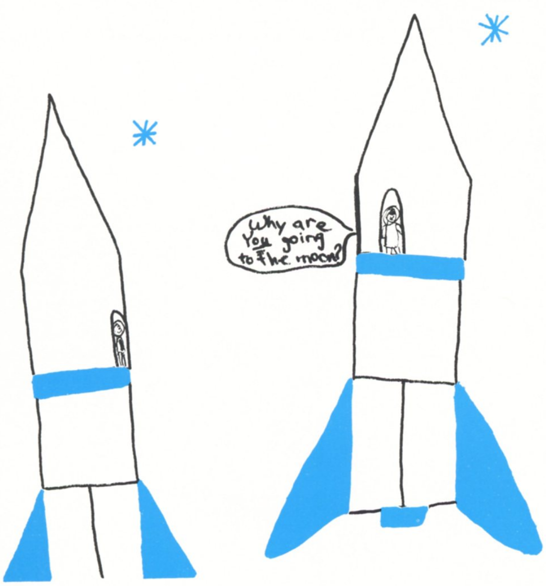
When man goes to the moon, who knows what he could find there. Even though, already we have sent men to orbit the moon. We know what its structure is like. But are we positive there is no life? When a satellite or capsule circles the moon, maybe some kind of life is hiding. They could live under ground.

But scientists are quite sure that there is no life, not even plant life. The moon has no atmosphere to keep something alive. But there is always that possibility.

Linda Angelotti





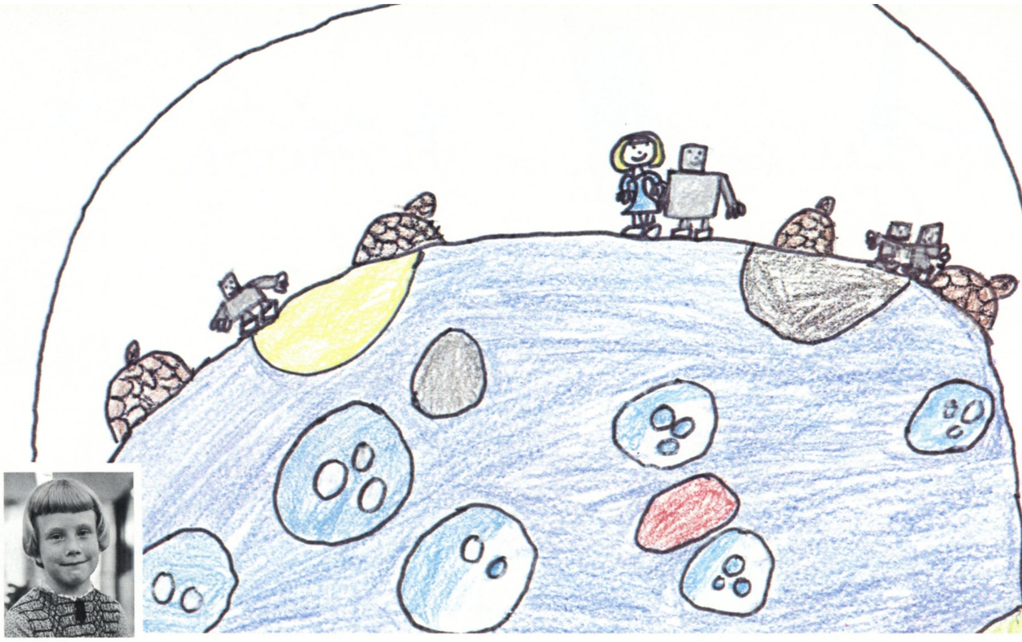


Why People Would Want to Go to the Moon

People might want to go to the moon for many reasons. Perhaps to get away from air pollution, loose a little weight, for athletes to be able to jump higher or just to do something new and different and to be able to explore.

All people have different reasons, of course some may not even want to go at all. If I had a chance to go I might accept, because nobody knows for sure what the moon is like, so I would like to find out. Perhaps I would go there just for adventure and something new.

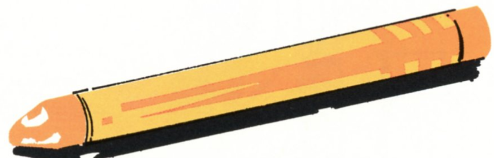
Ron Woodward
6th

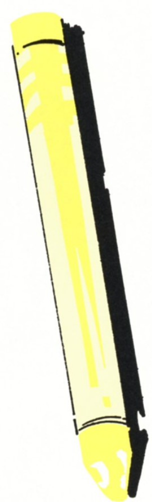


Life on the Moon

by Julie Tucker Age 7 Grade 2

Scientists are thinking about living on the moon. They will use spaceships to go to place to place on the moon. The houses will be round And they will be made out of rock. The sidewalk will be made out of rock, too. Instead of going to the store there is a spaceship that comes to your house from earth with supplies and food. In school the chidren do the same thing as us. Instead of dogs and cats for pets, they have moon monsters and they are very tamed and very playful. And a round the moon is going to have air in it so we can breathe.





BOY SCOUTING ON THE MOON

When people are taking round trips to other planets, and 200 miles an hour is slow, there will be scouts on the moon.

Think of your first night on the moon. Sleeping with built-in heaters in your space-suits. In place of animal noises and chirping, would be lifeless silence. You would feel over-padded in your space-suit and plastic sleeping bag. If you happened to look up, all you could see would be the tent's roof continuous with the floor.

It would be hard to get to sleep that night.

And imagine being First Scout on the Moon.

Paul Hart

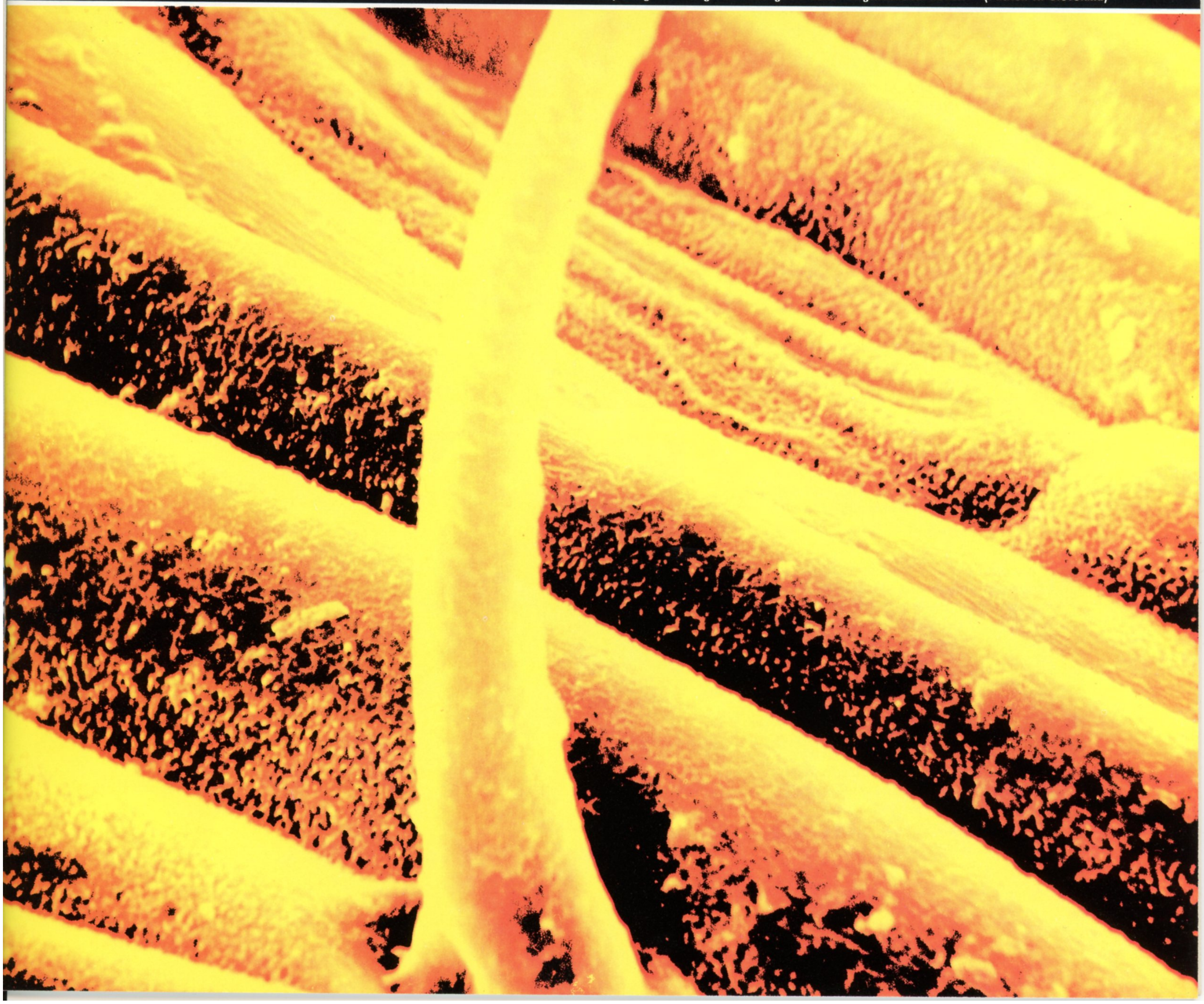
SEEING THINGS BIG

Electron microscopists at The Dow Chemical Company are able to see soft biological tissues in a way that they have never been seen before. The scanning electron microscope, a recent innovation, allows researchers to see spacial relationships of surface images up to 100,000 times their natural size.

Until now, scanning microscope studies on soft tissue have been hampered by the inability to preserve them in a relatively lifelike state.

Dow's Patrick H. Cleveland found a way to reveal the near lifelike surface structure of preserved tissue. This discovery has been applied at Dow by Cleveland, Dr. Arlene R. Seaman and Jon C. Fulfs. Their work gives scientists new insights into anatomy and into bio-medical problems.

Wax covered surface of wheat leaf shows a projecting hair process. Behind it is an air opening with rough surfaced guard cells. Magnification: 2600X (Patrick H. Cleveland)



SEEING THINGS BIG

Striking examples of different areas of application in the work of Dow microscopists on biological specimens illustrate what can be done with the scanning electron microscope. The tissue has been preserved in a relatively lifelike state.

1. *Fingerlike projections of the absorptive surface of the small intestine of a rabbit.* Magnification: 38,000X—Jon C. Fulfs

2. *Cilia in the windpipe (trachea) of a rabbit which assist in the physical movement of solid, particulate matter out of the lungs.* Magnification: 38,000X—Jon C. Fulfs

3. *Clump of red blood cells in a cavernous sinus at the base of a rabbit whisker.* Magnification: 3,100X—Jon C. Fulfs

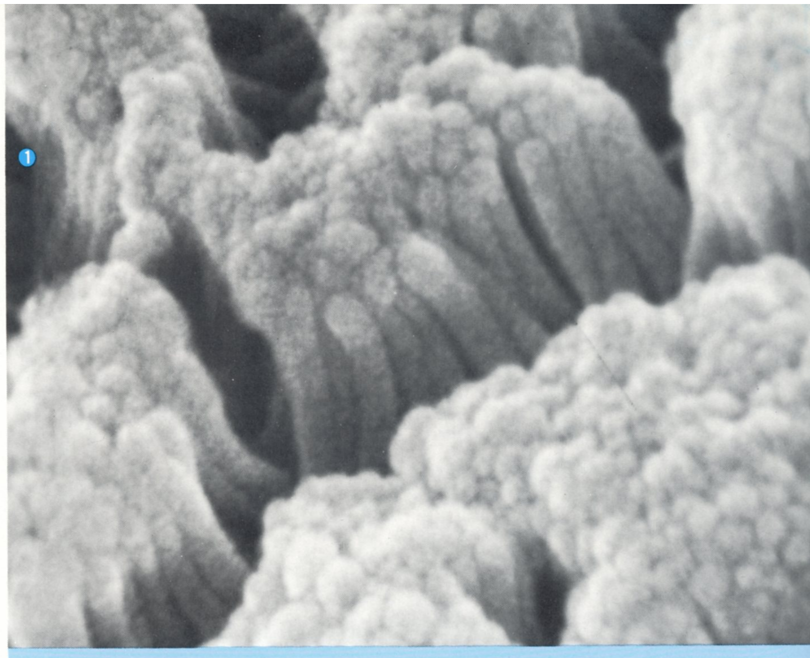
4. *The skin on the anterior surface of the external portion of a rabbit ear with a hair shaft projecting above the surface.* Magnification: 190X—Jon C. Fulfs

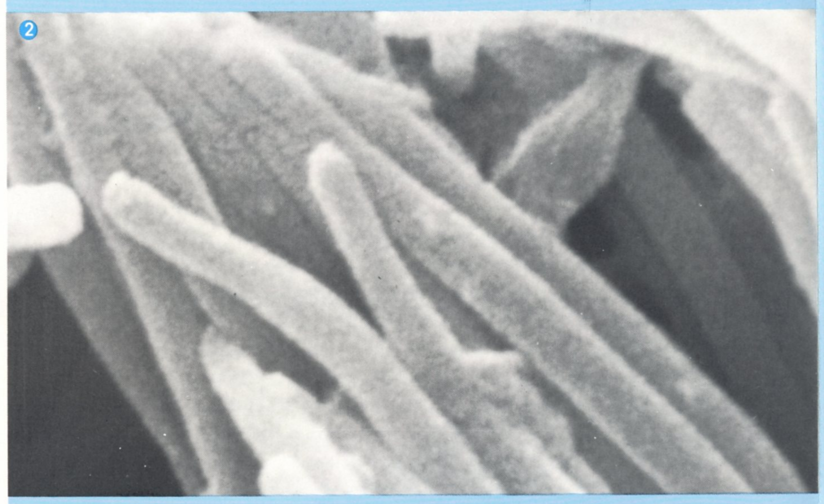
5. *A small artery of the vascular tunic covering the avian eye. The red blood cell lying in the lumen is characterized by an elliptical form in birds.* Magnification: 7,600X—Dr. Arlene R. Seaman

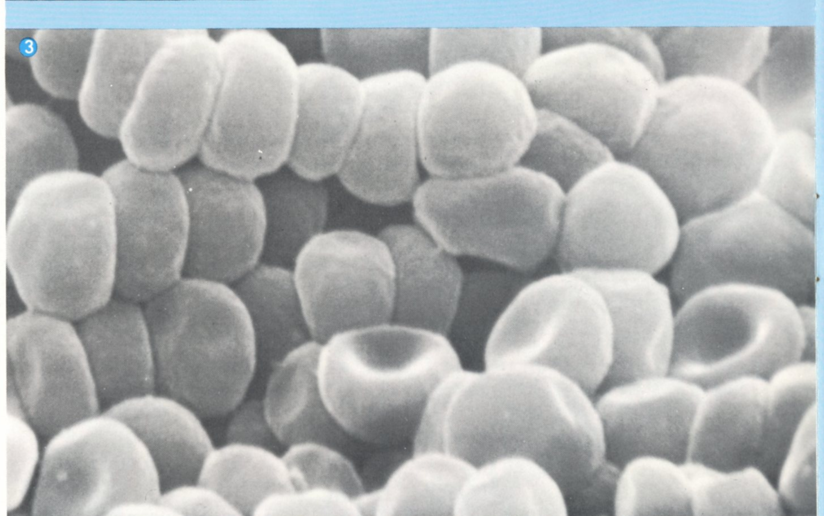
6. *Pigment cell from the suprachoroidal region of the mink eye. Collagen fibers can be seen laying over the pigment granules and the nuclear depression.* Magnification: 6,100X—Patrick H. Cleveland

7. *A dividing human liver cell grown in tissue culture. At this stage in division the daughter cells are connected by a bridge of cytoplasm. The fingerlike microvilli projecting from the cells increase surface area.* Magnification: 2,300X—Patrick H. Cleveland

8. *Two skeletal muscle fibers—jumping muscles—of a rat. The upper muscle fiber has been fractured open, revealing the numerous smaller units (myofibrils). The lower fiber surface shows numerous nerve cell endings.* Magnification: 7,500X—Dr. Arlene R. Seaman







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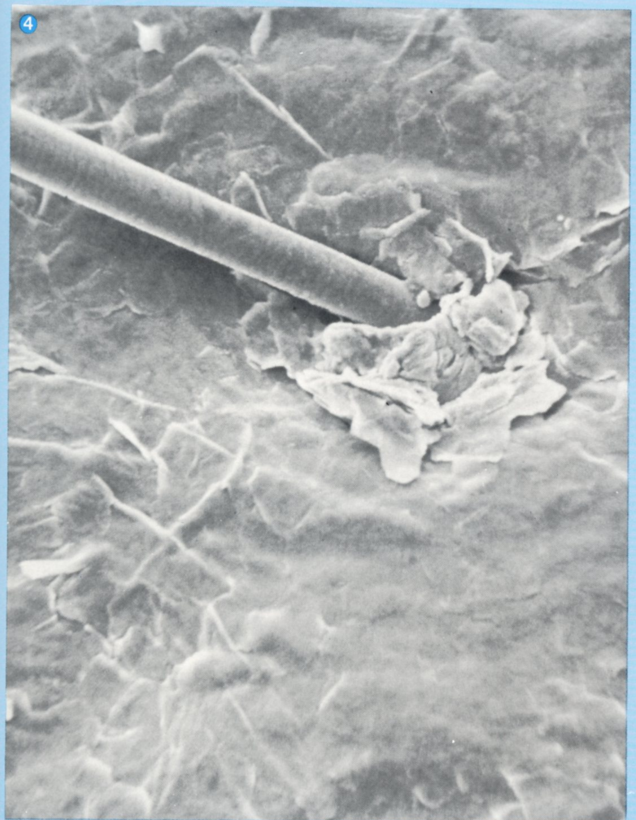

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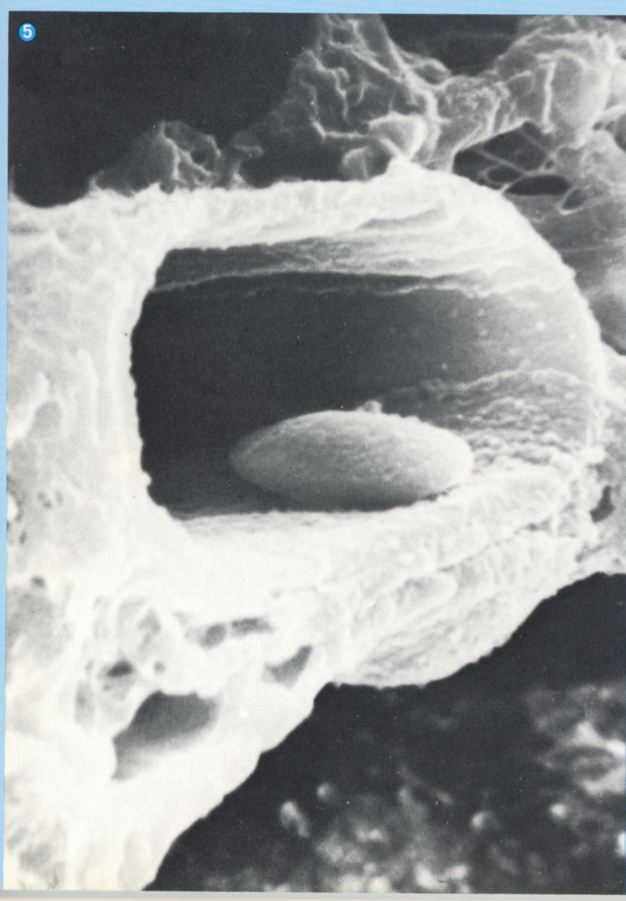

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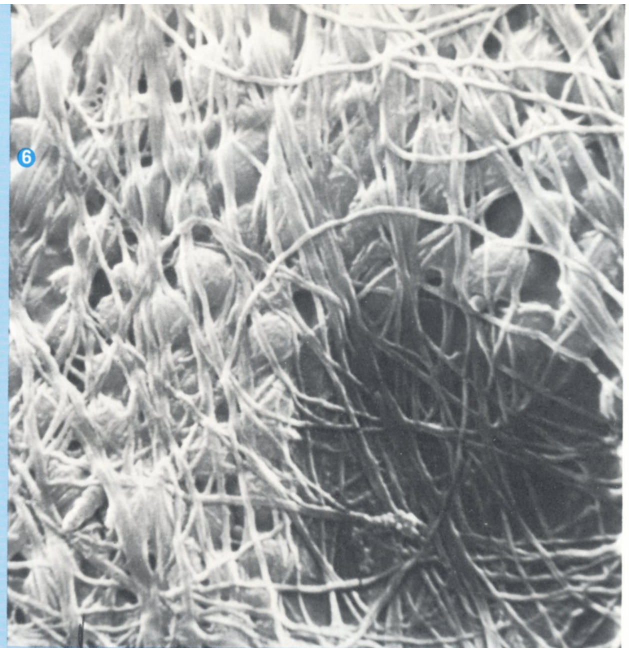

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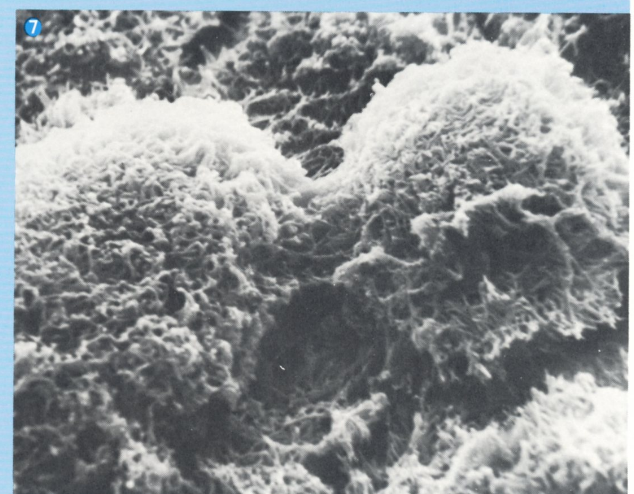

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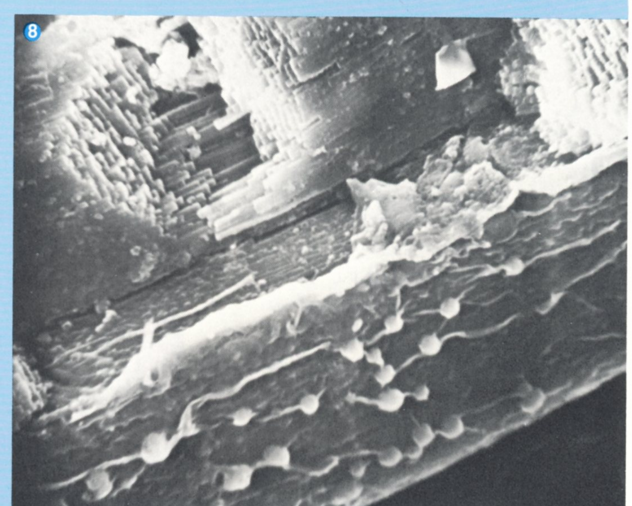
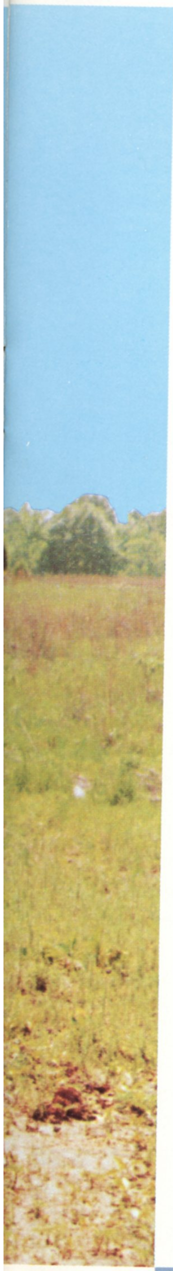



THE DOW CHEMICAL CO.
RUSSELLVILLE PLANT
ALUMINUM EXTRUSIONS
(UNDER CONSTRUCTION)



MANAGER WITHOUT A PLANT

THE MAN IN THE PICTURE at left is The Dow Chemical Company. Actually, he is Ed Ahlrich, manager of the aluminum extrusion plant in Russellville, Ark. But to people in the area he is still The Dow Chemical Company.

Right now, Ahlrich manages a plant that doesn't even exist. His domain includes mounds of dirt, scattered lumber, building frames, earthmoving equipment and a trailer which he calls his office.

Ahlrich will become manager of an operating plant at Russellville—about 75 miles northwest of Little Rock—early in 1970. In the meantime, he hasn't been sitting by idly. There is plenty to do before a plant is completed.

Ahlrich's main job, of course, is to supervise the construction of the plant which will house an 8,000-ton press, one of the largest in the South.

The aluminum extrusion plant at Russellville can be said to typify in most ways the building of many other Dow plants in recent years. Before the first spade is turned, there is much work to be done.

In the case of Russellville,—and this name probably wasn't even known when the initial planning was started—a need for a large aluminum extrusion press was determined by a product department in Dow's corporate offices in Midland, Mich.

Since the history of large aluminum extrusions was only 10 to 12 years old when talk was begun about a new plant in 1966 there was very little market research data available.

Preliminary plans were outlined and submitted to Dow's Board of Directors who approved the plant in late 1966. At the time the investment credit provision of the tax laws was under suspension. This held up the project. When the credit provision was reinstated, plans went ahead to have building specifications drawn up by the Engineering and Construction Services group at Houston.

Meanwhile, the important job of finding a location was taking place. Several important criteria were established. The plant had to be built at centroid of the main markets for aluminum extrusions, in this case the Middle West. The plant had to be located relatively close to Dow's Madison Division plant in Illinois to take advantage of people, services and equipment.

Breaking ground for aluminum extrusion plant at Russellville, Ark., were (from left) Carl A. Gerstacker, Dow Board chairman; then Mayor C. A. Hughes; Gov. Winthrop Rockefeller; and E. W. Ahlrich, plant manager.

MANAGER WITHOUT A PLANT

Very important would be the attitude of the community, the labor supply, the availability of good educational contacts and finally, a good place for employees to live.

Interest was centered in the middle South area and after visits to numerous locations, the small town of Russellville (12,000 population) was picked. At the groundbreaking on May 1, 1968 the first shovelfuls of dirt were turned by Gov. Winthrop Rockefeller; Carl Gerstacker, chairman of Dow's board of directors; and C. A. Hughes, mayor of Russellville.

Meanwhile, Ed Ahlrich had been named plant manager and he began making visits to Russellville from Dow's Freeport, Texas, plant. He had been a production engineer, assistant superintendent and superintendent in several different departments.

Now, at Russellville, he became The Dow Chemical Company. In this role, Ahlrich met with civic and business leaders; explained Dow's policies and practices, especially its employment practices, to the community; and cultivated friendships with the newspaper editor, the water company manager, a local attorney and the head of the Chamber of Commerce. Each of these persons, in his own way, has helped make the transition period a little easier for Dow.

Getting off on the right foot in a new community is an important job for any company. In Dow's case, getting off right has been the accomplishment of its manager without a plant, Ed Ahlrich.

Ahlrich chats with local citizen on downtown corner. Russellville is located about midway between Little Rock and Fort Smith.

Business leaders are among groups to which Ahlrich outlines Dow's plans.

Ahlrich discusses job possibilities at new plant with Paul Gardner of Arkansas employment commission.

Chamber of Commerce endorsement is given by Dr. J. W. Hull, formerly president of Arkansas Polytechnic College.

Local attorney Robert Hayes counsels Ahlrich about legal responsibilities.

Visit is made to J. H. Fondren, at water company.

Bill Newsome, editor of the local newspaper, shows Ahlrich front page of edition carrying news that bond issue is approved by citizens, giving Dow the go-ahead to build plant at Russellville.

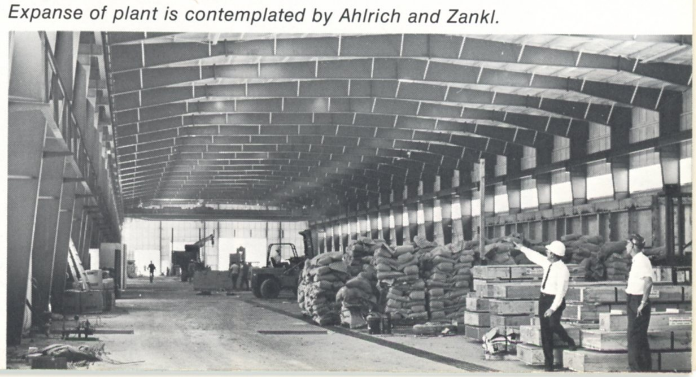
Educational facilities are discussed in a talk with Dr. George Pratt, president of Arkansas Polytechnic College.

Ahlrich learns about medical facilities at clinic from Dr. Roy I. Millard, a staff physician.

In the temporary trailer office, Linda Cassell takes shorthand, handles other office jobs.

Ahlrich and Lou Zankl, plant supervisor, watch earthmover excavate for equipment foundation.

Expanse of plant is contemplated by Ahlrich and Zankl.



GOING DOWN TO THE SEA

At Lakehead, Ontario, in the heart of the North American continent, an ocean freighter an eighth of a mile long shrugs away from a grain elevator, turns, and begins a lumbering arc across Thunder Bay; she is headed for the Atlantic Ocean, 2,000 miles away and 602 feet straight down, with a cargo of Canadian wheat for the tables of the world. Her route will take her past the rocky crags and piney ridges of the Canadian wilderness, past the cities of Sault Ste. Marie, Detroit, Windsor, Buffalo, Hamilton and Toronto, through the narrow waists of canals, through lock and lake and river to the embracing sea. Her route is the St. Lawrence Seaway.

TENTH ANNIVERSARY ST. LAWRENCE SEAWAY

❶ *Detroit waterfront is very busy during the Great Lakes-St. Lawrence Seaway season.*

❷ *View of Welland Canal in Canada where seaway-bound ships bypass Niagara Falls.*

❸ *Toronto harbor on Lake Ontario has boomed since opening of the seaway in 1959.*

❹ *Dow ships much of its product out of the Port of Bay City on Saginaw Bay, Michigan.*

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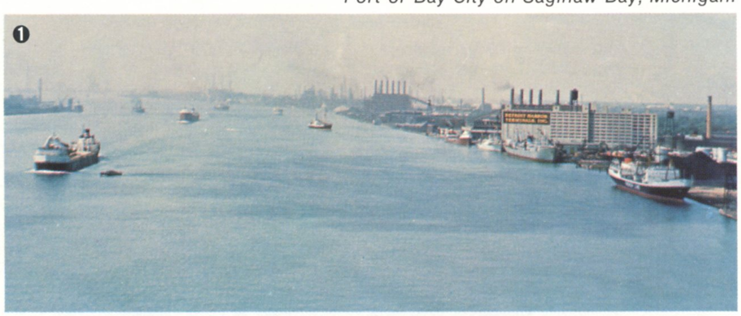

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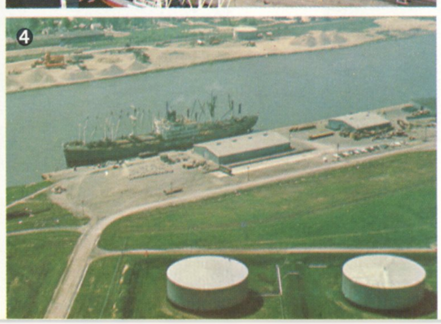
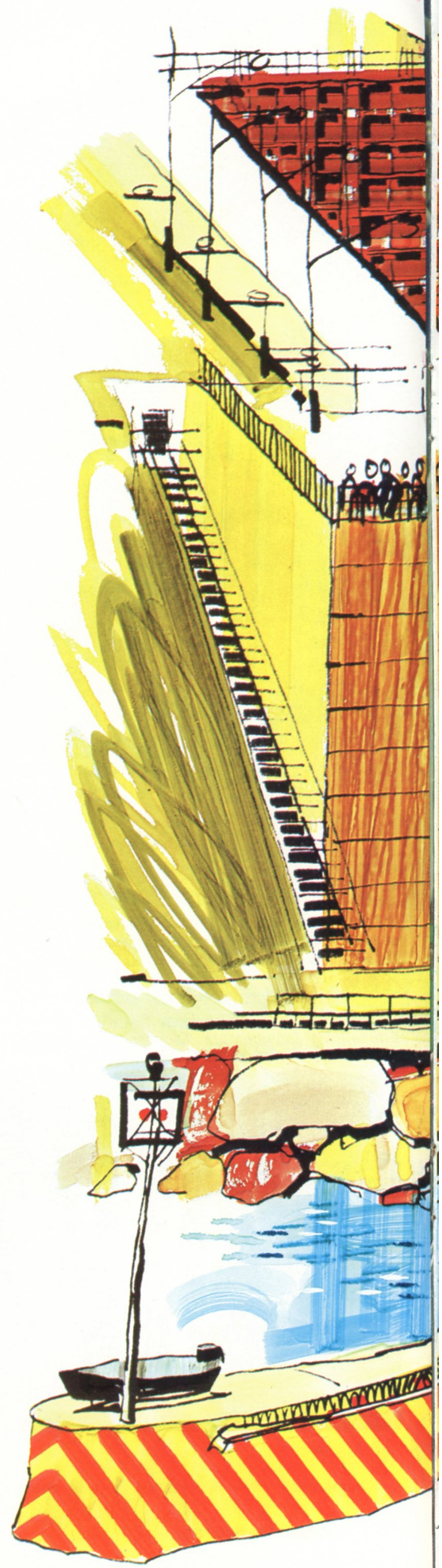
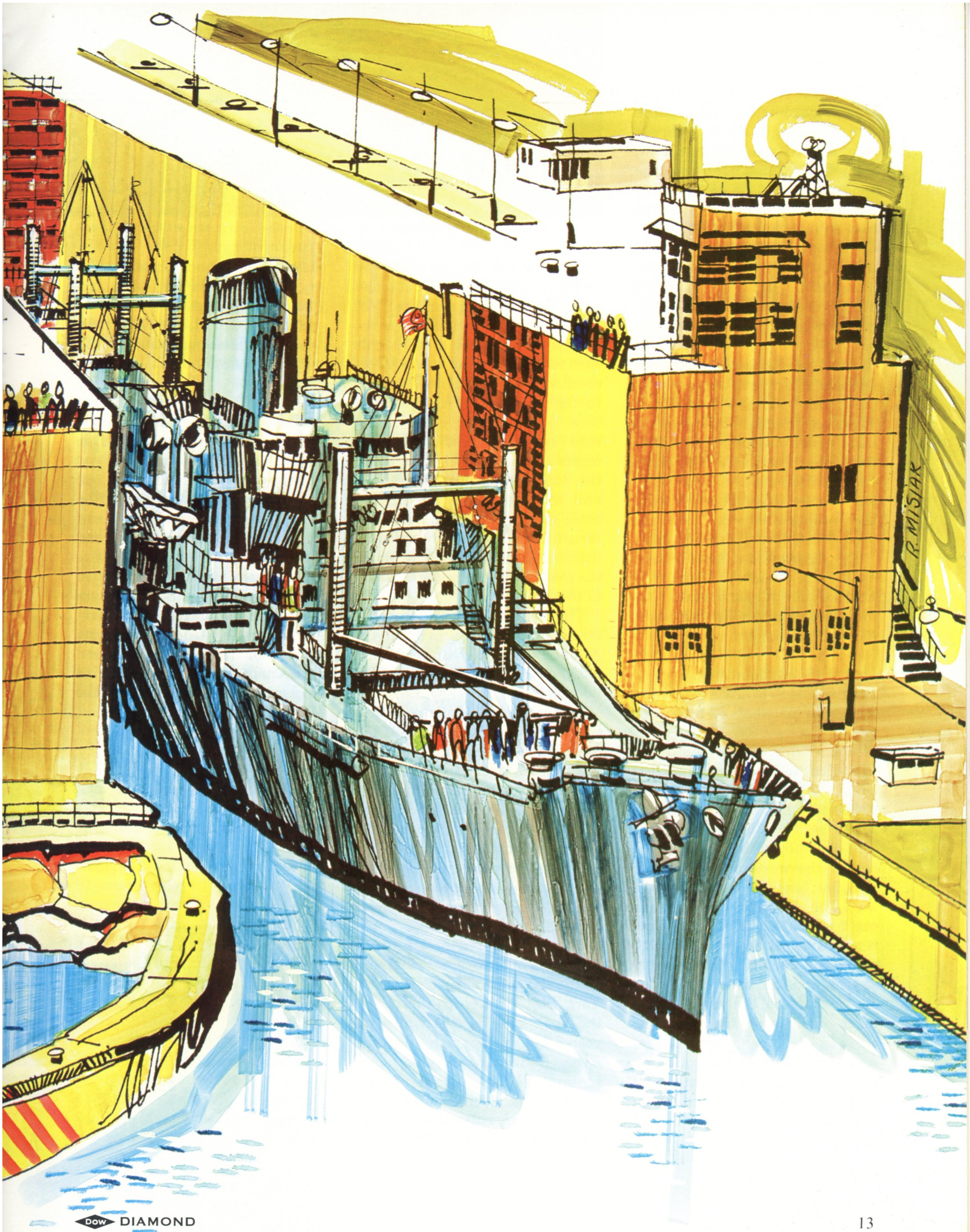





R. MISIAK

Great Lakes-St. Lawrence Seaway stretches 2,400 miles from Duluth to Atlantic Ocean.

This international inland waterway completed its first decade of service in April, 1969, and in those 10 years carried more than 350 million tons of cargo, welcomed the flags of 30 seafaring nations and helped to enrich and enliven the lot of 61 million Canadians and Americans who inhabit the provinces and states along its flanks. For the 7,300,000 people of Ontario, for instance, the Seaway has meant spectacular growth in shipping activity—for the port of Toronto alone, a 500 per cent increase in overseas consignments—thousands of jobs in construction and operation, a huge power development, and the collateral benefits of the tourist trade, as ship-watchers flock each summer to look-outs provided by the Seaway Authority to see the mighty cargo carriers churn past.

The Seaway has known labor strife and financial turmoil in its brief life-span, and its development problems are far from over, but the project has cut shipping costs, opened the industrial heartland of the continent to the ocean, and fixed itself firmly in the North American network of trade and travel.

This unique waterway owes its existence to the fact that the Great Lakes are strung across the eastern half of North America like a series of bowls set in the side of a hill, with the top of the hill at the western end of Lake Superior, and the bottom at the sea. The lakes pour into each other and down into the St. Lawrence River with a rush of water averaging 246,000 cubic feet per second, and this flood carries the double potential of hydro development and water transport. As early as 1897, men planned a seaway to tap this double potential, but the necessary international agreement was stalled, first in Canada, then in the U. S., for nearly six decades.

Construction began in 1954 and, five years later, Canada had spent $340 million and the U. S. $130 million on navigation works. The patchwork series of canals then linking the lakes was deepened and a new channel gouged in the bed of the St. Lawrence. New bridges were built to lift road traffic over the towering masts of ocean vessels and, along the 400-mile stretch from Montreal to Lake Erie, 114 million cubic yards of mud and rock were thrust aside and seven new locks inserted to lift ships up and down the giant stairway from the ocean to the lakes.

The result was a waterway stretching 2,300 miles from the Atlantic Ocean to Duluth, Minn., a distance greater than that from London to Cairo.

To harness the system's power, the Province of Ontario and the State of New York joined in building a massive generating complex in the International Rapids section of the St. Lawrence, near Cornwall, Ont. For Ontario, that power development has been the single most important aspect of the Seaway, a source of pride and potential growth for decades to come.

The gigantic engineering task was undertaken by Ontario Hydro on the Canadian side and the New York State Power Authority on the U. S. side, each of which invested $300 million to harness the river. Twin powerhouses, each containing 16 generators and capable of producing more than 9,000,000 kilowatts of electricity, were laid across the riverbed to meet on the international boundary. To provide a power pool upstream, two dams and 16 miles of dyking were built, creating a new lake, 100 miles square and brimming with 28.5 billion cubic feet of water.

On the U. S. side, the flooding affected only 225 farms and 500 cottages, but in Ontario, seven whole villages and part of an eighth were wiped out, and 6,500 people uprooted. At first, the evacuees were apprehensive about the move, but the fairness and generosity with which they were treated soon set most minds at ease. To replace the flooded villages, two new towns—Long Sault and Ingleside—sprang up; the village of Iroquois was moved three-quarters of a mile, and a new subdivision was added to the town of Morrisburg. New homes, churches and stores were provided to replace the old; and for those who did not want new houses, Ontario Hydro undertook to move the old ones. In all, 531 houses were cradled in the arms of giant building-movers and shifted to new locations. In addition, 35 miles of highway and 40 miles of railway were relocated, along with no less than 18 cemeteries. All of this was accomplished in an atmosphere of goodwill and cooperation that was a tribute to both Ontario Hydro and the displaced families.

More important even than the new towns and new parks is the surge of power now tapped by Ontario in the river, enough to fill the needs of 600,000 homes and swell the industrial muscle of the entire province. This power development alone made all the money, work and anguish seem worthwhile when the Seaway opened for business on April 25, 1959.

Before that opening, the massive, bathtub-shaped "lakers"—a single one of which can carry 28,000 tons of iron ore, or the produce of 50,000 acres of grain—were cut off from the Atlantic by the small canals by-passing the St. Lawrence rapids. These large, efficient carriers were obliged to transship their cargoes at the eastern end of Lake Ontario into smaller, less efficient canallers. At the same time, only small ocean ships, drawing less than 14 feet of water, could penetrate to inland ports, and their capacity was less than one-tenth that of a "laker."

The Seaway, with its 27-foot-deep channel, made room for the giants of the sea, and opened inland ports not only to the ore and grain which has always dominated our water transport, but to wine from France and caviar from Russia and transistors from Japan, all carried directly, quickly and cheaply from their ports to ours.

The Seaway is a mighty, computerized machine, and the ships whose wakes wash its banks are complex, efficient and, perhaps, a little dull beside the tough, dirty tubs of yesteryear. Here is one old-timer's comparison:

"We had no radar in those early days and no automatic steering, nothing like that. We sailed by lead, log and luck. I remember a storm in 1913 when 65 ships went down. We rode it out for 35 hours and made three miles. The captain and I hung onto a wheel as big as this room, hung on for dear life. The captain had one hand on the wheel and the other on the telegraph. Every time her tail came up, he'd order the engines off so's she wouldn't throw her prop when it cleared the water. We were riding empty and the captain said to me, 'Frank, d'you think I should open her bottom and take in water to steady her down?' and I said, 'No, sir, Captain, I think we're going to get all the water we can use right over the side.' We did, too. It wasn't throwing spray over the spars, it was throwing blue water, and see, those spars were 90 feet up! . . . Today, with better weather forecasts and better equipment, you don't get into a bind like that . . . And did you know, sailors today have TV in their cabins?"

Most sailors would rather have television than a storm to help them pass off-duty time, and the opening of the Seaway showed at once what had been lost in romance was more than made up in efficiency. In its first year of operation, the waterway carried 7,452 vessels and 21.5 million tons of cargo past Montreal, compared to the 12 million tons that used to pass annually through the old St. Lawrence canals. Since then, the cargo tonnage has climbed steadily, to 48 million tons in 1968.

The future promises still greater things to come. Bigger, better ships, more advanced packaging methods—including the increased use of containerization—a longer shipping season and the experience that leads to faster, cheaper handling of vessels have all increased the Seaway's carrying capacity from the 50 million tons forecast in 1958 to about 65 million tons today. Many experts feel that, with expected improvements to come, the Seaway will one day be capable of handling 80 million tons of cargo per year.

There can be no doubt that in its first busy decade, the St. Lawrence Seaway has already proved its worth; the route where voyageurs once paddled furs and rum has become a vital link in the transportation system of all the modern world.

H. D. Doan, president of The Dow Chemical Company, is general chairman of the Governors' Committee, Tenth Anniversary, St. Lawrence Seaway.

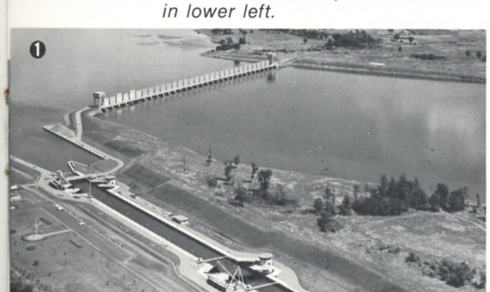
The committee is composed of governors of Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania and Wisconsin.

Site of the opening ceremonies for the celebration on June 26 is at Sault Ste. Marie, Michigan. Concurrent ceremonies in Canada the same day will be held at Montreal on Expo Island, eastern terminus of the Seaway. Throughout the period June 26-July 7, the entire Great Lakes region will present programs connected with the celebration.

Dow has greatly increased its shipping through the St. Lawrence Seaway since the opening in 1959. Presently, Dow is the largest Michigan chemical shipper through the Seaway and ranks high among all shippers. The company uses the Port of Bay City to move its products to overseas destinations.

❶ *Iroquois Control Dam, upstream from Moses-Saunders Dam, regulates outflow from 300,000 square mile watershed of the five Great Lakes into Lake St. Lawrence.*

❷ *The Moses-Saunders International Power Dam is operated by Ontario and New York State to produce 1.8 million kilowatts of power. Locks are in lower left.*



ASSIGNMENT: OVERSEAS

WITH AN INCREASING emphasis on overseas markets, The Dow Chemical Company has had to solve numerous problems inherent in such an expansion.

Not the least of these has been the initial staffing of offices and supervising of plant construction by trained personnel. The interim step before such staffing can be accomplished through nationals is to provide qualified Dow people, experienced in the company way of doing business.

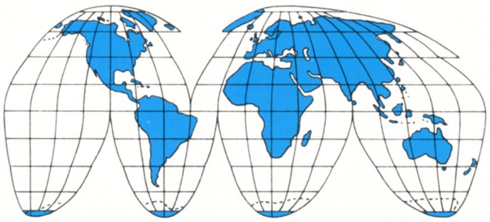
Outside the U.S. Area and Dow Chemical of Canada Limited, the company provides products and services in three major foreign markets: Europe/Africa, Latin America and Pacific Area.

At present, some 200 United States citizens are assigned for varying lengths of time to overseas jobs.

A recent transferee is James W. Manston. He was appointed project manager for engineering, construction and initial operation of the Dowpon grass killer plant to be built in Kuala Lumpur, Ma-

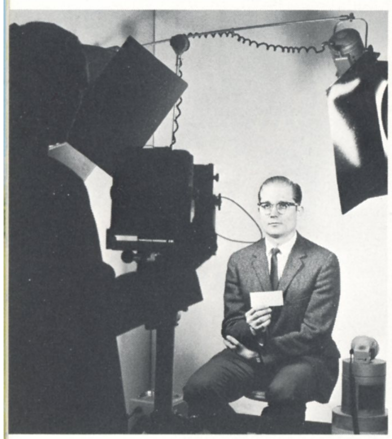
Jim Manston, with others, is given briefing in Midland before leaving on new overseas assignment.

Manston family, escorted by sarong-clad hostess, arrives at Kuala Lumpur's Subang Airport. Later Judy Manston visits Chetawaon Buddhist Temple at Petaling Jaya (above) and then shops at local market place.



ABOVE: Malaysia is pointed out to Judy by her husband as Harold Smith, Corporate Transfer, who coordinates overseas moves, looks on.

LEFT: Rev. Glenn Baumann of United Church of Christ in Midland reassures Daniel, Sarah and James about moving.



ABOVE: Manston is photographed for passport picture by Dow Audio-Visual cameraman.

RIGHT: All members of family must receive medical shots. Here Sarah gets hers while James waits.

BELOW: Before leaving, Mrs. Manston shops for last-minute items, such as sun glasses. At far right, James watches as mover crates belongings.

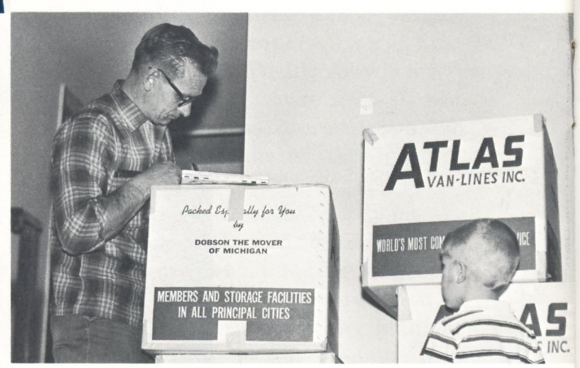
laysia. Manston worked in production, planning and control in the Midland Division when he was picked for the new assignment.

How is an employee selected for overseas assignment?

The Jim Manston case is as typical as any.

A decision had been reached in the Pacific Area to build a Dowpon plant in Malaysia. Dr. Jay H. Ashley, manager of technology and economic evaluation for the Pacific Area, felt that someone from the United States should oversee the construction and beginning operation of the plant.

He sent word to Corporate



The Manstons are joined for lunch by the John Weselohs. On the menu is satay, a dish of small pieces of barbecued meat marinated in sauce and eaten with rice cakes, peanut curry sauce and cucumber.

During visit to specialty shop, Manstons are interested in printed batik cloth, handbags of snake and brass vase.

Transfer in Midland which is charged with the responsibility of matching people with jobs overseas. Of paramount importance is an employee's technological knowledge.

Chet Otis and Harold Smith, who coordinate the program, say:

"We get managers, Industrial Relations reps, and others to submit lists of persons they feel would qualify for the position. We talk to selected candidates. During the interview the employee can change his mind or the company may reconsider its offer. A prospective overseas employee may talk to as many as eight interviewers. In fact, there are times when we find it advantangeous both for the employee and Dow to have a visiting psychologist talk to the family in the home."

Once selected, the employee goes through a series of Industrial Relations interviews.

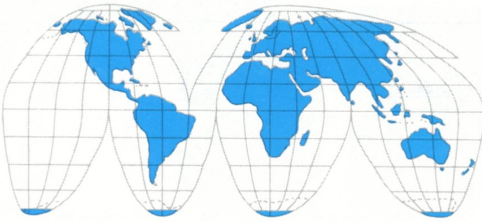
Reviewed are his eligibility in the stock plan (he is), social security (deductions must be made to keep the employee eligible), foreign location allowance, U.S. income tax (he must pay these taxes and the company protects him against paying any overage), housing (various options are open), moving expense (there is a formula) and other important financial matters.

Meanwhile, the family receives a physical and necessary shots. Depending upon the employee's destination, the employee and his wife are enrolled in a language development course. Since children are usually enrolled in English-speaking schools overseas, they do not receive language instruction before leaving.

If it is felt that the area to which the employee is assigned should require a deeper knowledge of the cultural background, the man and wife receive a special

Plans for Dowpon plant are reviewed by Manston and the architect. Plant site is 15 miles outside the city.

Manston plays round of golf with members of Dow staff at the Royal Selanago Golf Club. Facilities also include large swimming pool and 16 grass tennis courts.



Sarah mixes freely with her classmates.

indoctrination program.

Transportation arrangements are handled directly by the employee with the Company, of course, paying the fare. The entire moving of goods is arranged and supervised by the company.

While the employee works at his job overseas, he still remains eligible for positions in the United States—or other foreign offices and plants.

Conversely, there are many nationals presently training in the United States to assume the jobs now being held by Americans. As Dow employees, they are equally eligible for positions anywhere in the company—domestic and foreign.

The overseas placement program has been in operation for some 18 years. As Dow expands its business outside the United States (in 1968, some 33 per cent of the company's sales came from non-U.S. areas) more trained persons must assume vital roles.

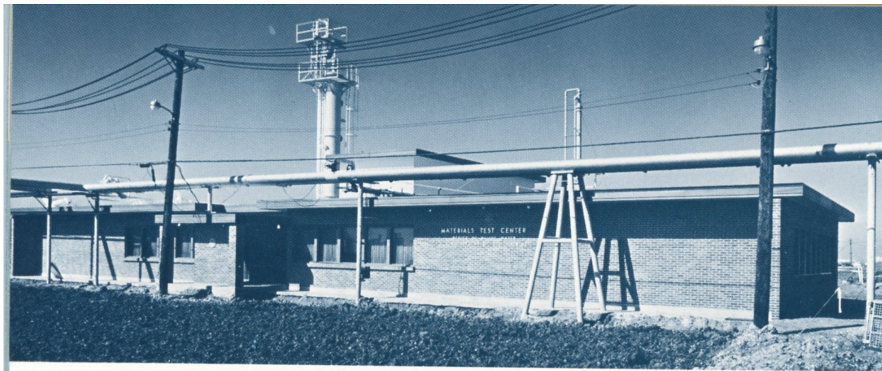
Jim Manston, now in Malaysia with his family, typifies the many employees overseas who help extend Dow's horizons.

Manstons tour grounds around the Malaysian Parliament House. Building rises 250 feet.

Sarah chases a classmate at the Garden School. Various national groups are represented at school, European, Malay, Chinese, Eurasian and American. At right, Manstons relax on terrace of their air-conditioned home, only five minutes from the Dow office in Kuala Lumpur's commercial center.

for tomorrow's water

"WE NEVER KNOW THE worth of water till the well runs dry." This old proverb rings so true today. The assurance of adequate water supplies depends, to a great extent, on the success of scientific and technological efforts now underway to solve this problem of a thirsty world.



Research is done in main building of the Materials Test Center of the Office of Saline Water at Freeport, Texas.

In the United States, the continuing task of securing water for all is one of the functions of the Department of the Interior. Established in 1849, the Department of the Interior directs programs to manage, conserve and develop the country's natural resources.

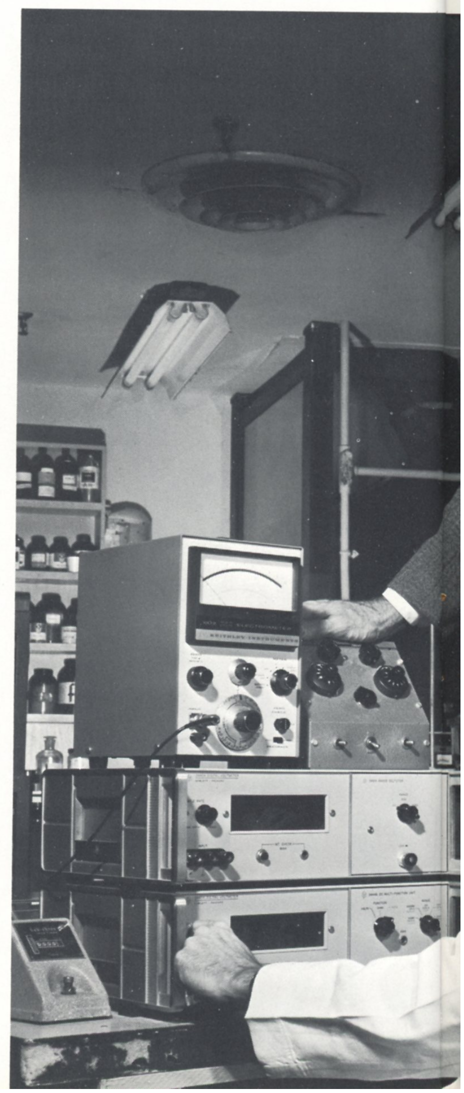
One of these facilities is the Materials Test Center of the Office of Saline Water, Department of the Interior, at Freeport, Texas. This new facility is devoted primarily to studies of materials used in converting seawater to fresh water. Much of the work at this installation is under joint sponsorship of both industry and government in the search for more economical construction materials for water desalting plants. The desalination industry eventually will require untold millions of feet of tube and thousands of tons of plate, sheet and castings as materials of construction.

It is now expected that by 1970 approximately $3 million will have been spent or committed to be spent by the Office of Saline Water (OSW) and by industry at the Freeport site on research and development of these materials of construction for desalination plants. The Materials Test Center is planned to have a staff of 15 engineers, scientists and technicians.

The Dow Chemical Company, funded by OSW and industry, has a number of contracts active and pending at the Materials Test Center. Dow also prepared the operational plan, conceptual design and plans and specifications for the seawater corrosion test facility. Construction of the building housing the test loops, laboratories, and offices of the Materials Test Center was completed early in 1969.

The long-range goal of the Materials Test Center which Dow operates for OSW and industry is to find heat exchanger tube materials for desalination plants that will last for 20 to 30 years.

While the principal method for the conversion of salt water to fresh water – the distillation technology – has reached a high state of development, a major factor in the improvement of economical



conversion of seawater to fresh water depends upon the development and testing of economical construction materials. Furthermore, when higher-temperature desalination methods are developed, the demand for corrosion resistant materials will be even more important.

The Dow Chemical Company is uniquely qualified in the area of corrosion research. Many of the products manufactured and many of the services offered today by Dow could not have become realities had not the destructive effects of corrosion been successfully combatted.

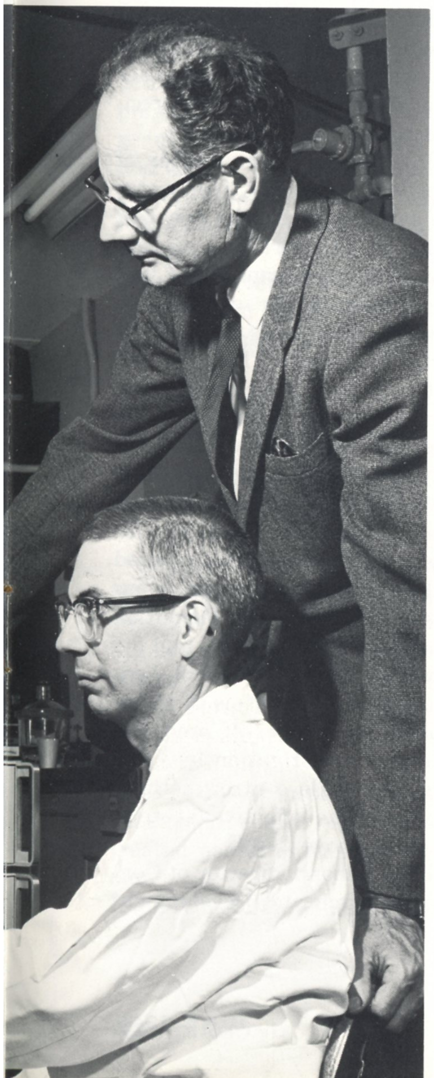
Some specific examples of Dow operations, products, and services in which corrosion is of great importance include the extensive use of seawater as a coolant and raw material; the handling of corrosive chemicals such as chlorine, hydrochloric acid, and caustic; the use of magnesium as a structural material; the development of magnesium and aluminum as cathodic protection anodes; the development of paints and plastic coatings; the development and corrosion inhibition of automotive antifreezes; the treatment of oil wells; and the cleaning of boilers.

In the corrosion field during the past 15 years, Dow research and development personnel have generated some 3,000 internal reports, published 70 papers, and have been issued 50 patents.

Dow has engaged in numerous cooperative seawater corrosion research and testing programs with such companies as U.S. Steel, International Nickel, Aluminum Company of America and the American Brass Company.

Dow has also worked with associations such as The American Society for Testing Materials, American Welding Society, American Zinc Institute, the Copper Development Association, the Aluminum Association and the Stainless Steel Producers Committee of the American Iron and Steel Institute.

The Texas Division at Freeport, where the Materials Test Center is located, has been a fountainhead of corrosion control technology because of the necessity of employing seawater as a cooling agent. At the present time, more than 2.8 billion gallons per day of seawater are handled, and major corrosion problems associated with it are solved. Dow, a



Oliver Osborn, Dow's manager of the OSW R & D Contracts at the Texas Division, observes Billy Oakes, senior research chemist, at instrument.

The Water Problem

The world's supply of water is virtually limitless, but large areas of the globe today are short of pure, fresh water. People and plants are thirsty. There is enough water for every single person, but 98 per cent is undrinkable — it contains 3½ per cent dissolved minerals, mostly salt.

The problem of salt water is ages old. In 49 B.C., Julius Caesar attempted to convert salt water to fresh water during the siege of Alexandria. In 1963 A.D., in the United States, President Kennedy said: 'If it can be done inexpensively, it will dwarf any other scientific accomplishment . . .'

Today, water desalting is crossing the lines which separates hopes and dreams from practical use . . . and may result in a whole new industry. Desalination, within the next few years, could become an enterprise comparable to oil or mining.

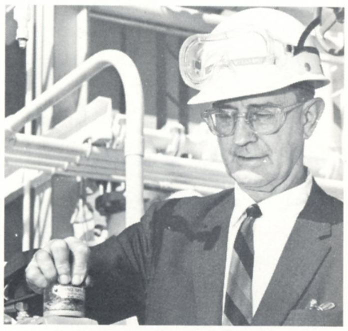
The United States today is using approximately 360 billion gallons a day of fresh water. The demand is increasing at the rate of 25,000 gallons a minute.

Obviously, new sources of fresh water are needed to supplement and, in some instances, replace dwindling local water supplies. The four principal methods of supplying water-short areas are transporting water, desalting seawater, desalting brackish water and water re-use and reclamation.

Desalination will play a major role in helping to reach the objective of water for all humanity.

W. P. Schambra serves as proposal manager for many of R & D contracts with OSW.

Julian Williams, senior research engineer, checks equipment at seawater treatment plant.



Charles Grua (red hat) resident manager for OSW at Freeport, talks with Dow's project leader Hugh Behrens.

Dr. John Wilson, Dow research specialist, watches W. J. Bettin at the environmental modification test apparatus.

company founded upon brine chemistry, thus has desalination business opportunities in the area of research and development, services and products.

Initial test programs for the new test facility involve the following:

• Behavior of the most promising families of materials under desalination conditions, sponsored by the OSW.

• Performance of copper-based alloys, sponsored by the Copper Development Association.

• Performance of aluminum alloys, sponsored by the Aluminum Association.

• Performance of stainless steel alloys, sponsored by the Stainless Steel Producers' Committee of the American Iron and Steel Institute.

• Reliability of coatings and cathodic protection, the effects of impingement (erosion), and other causes of materials failures, sponsored by OSW.

While there are a number of methods of producing fresh water from saline sources, the new test facility at Freeport will concentrate on the performance of materials used in the evaporation processes known as the Multi-effect, Multi-stage Flash System and the Vertical Tube Evaporator.

An important function of the Materials Test Center will be to study the effects of high-temperature seawater on materials. Fresh water production efficiency increases as the temperature used in the conversion process is increased. However, the formation of calcium sulfate scale and its deposition on the walls of heat exchange equipment is a major problem. A number of processes are under investigation by OSW to develop scale control methods which will be effective at temperatures above 250°F.

Oliver Osborn, director of Contract Research and Development for the Texas Division of Dow, says, "When scale control methods have been developed for higher temperatures, the demand for corrosion-resistant materials will be paramount. There is no doubt that these methods will be developed and that the immediate need is to find materials that will withstand the extremely corrosive environment at higher temperatures."

Dow's Materials Test Center program with OSW is headed by Osborn, whose group works closely with the Contract Research and Development group of Dow's Government Affairs Department in Midland in program planning, proposal preparation, contract negotiations, and contract administration. W. P. Schambra, senior R & D contract specialist in Midland, serves as proposal manager for Dow's OSW activities in the materials test program. He coordinates the program with Osborn and his staff and with A. T. Maasberg, director of Government Affairs Contract R & D, and I. G. Morrison, assistant director.

Key members of Dow's Contract R & D team involved in the materials test program include C. F. Schreiber, H. C. Behrens, H. G. Smith, W. F. McIlhenny, Billy Oakes, J. T. Reding, Lavern Rice, Julian C. Williams, and Dr. John Wilson.

OSW officials directing the Materials Test Center effort include Leroy Yates, chief, Materials Technology Division – Engineering and Development, OSW, and Dr. F. H. Coley, chief, Materials Division – Research, in OSW at Washington, D. C.

The Materials Test Center is located on a 14-acre tract deeded to the U. S. Government by Dow. It is located adjacent to the OSW's First Seawater Demonstration Plant at Freeport which has been in operation since 1961. This desalting plant is capable of producing one million gallons of fresh water a day by the vertical tube distillation process.

Activities at Freeport involving OSW, Dow, and participating firms and industrial associations are a part of the nation's overall desalination program involving government, industry, and educational institution participation. The Materials Test Center will play a major role in helping to economically slake the thirst of man and his world.

Seawater treatment plant at Materials Test Center pretreats seawater to remove carbon dioxide and oxygen.

What the Materials Test Center Does

Objectives of the Office of Saline Water Materials Test Center at Freeport:

1. To provide a site and service where

   a. Joint industry-OSW materials evaluation programs can be carried out.

   b. OSW-sponsored materials research requiring flowing, treated seawater can be carried out.

   c. Unexplained material failures in operating plants can be studied by simulation.

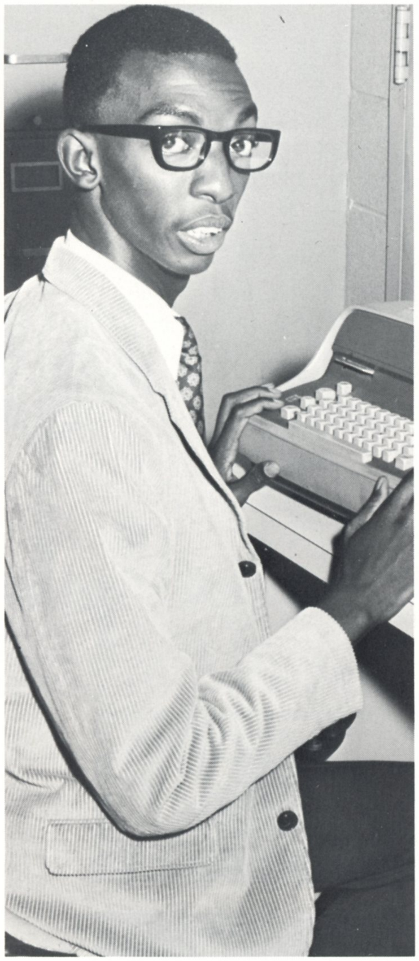
   d. Industry can obtain preliminary evaluations of certain proprietary materials.

2. To provide a team of competent materials specialists seeking to advance materials of construction technology in desalination.

3. To provide a technical service in the materials field to the Office of Saline Water.

The technical program involves materials development and testing, technical liaison, and dissemination of information.

It is generally agreed that economic conversion of seawater will be a reality. The time required to realize this dream, however, depends on the reliability of data and the advancement of materials technology produced at the new OSW Materials Test Center near Freeport on the Texas Gulf Coast.



MR. DOAN:

BUSINESS *CAN* HELP IMPROVE GHETTO AREAS ...BUT WHAT—IF ANYTHING —IS BEING DONE?

Dear Mr. Doan:

Recently, it has become apparent that if black Americans are to thrive and to advance themselves, there is a need for group solidarity and a collective manipulation of the American system. Such involvement implies the development of economic and political bases of power. Political self-assertion and economic potency are notably allied, and both are absolutely necessary to effectively deal with the American system.

Most black Americans live in urban ghettos. If these people are to be helped, it seems that their neighborhoods are the places in which to begin developing such power bases. ''Big business'' should be concerned with development in these areas because their improvement will benefit the entire economy. Nevertheless, concern alone is inadequate.

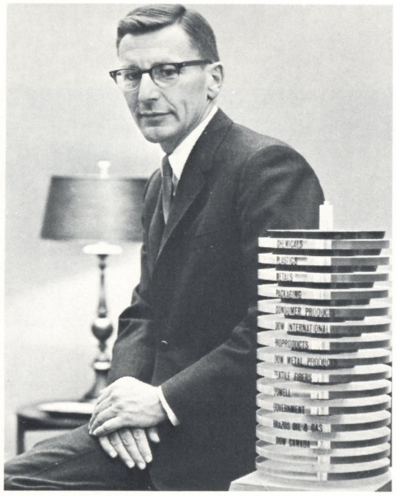
Business can assist in the revitalization of these areas. Cooperation with the existing ghetto leadership, helping residents to set up businesses which will meet the immediate needs of their community and others, and the initiation of intensive management training programs for those who will administer these businesses are of primary importance. Aid in terms of circumventing legal red tape, of finances through outright gift or long-term loan, and the provision of any other technical assistance possible, if needed, should be rendered enthusiastically. An expedient of this sort seems to be the solution for stimulating the black community and enfranchising its members.

What is your opinion about this issue, what action has already been taken by the business community in the direction presented above, and what action do you foresee being taken in the future?

Sincerely yours,

William E. Hill

William E. Hill
Sociology, Tulane University



Dear Mr. Hill:

Yours is a constructive, refreshing letter, and I fully agree with the points you made. In fact, I believe more businessmen than you think would agree with you. Unfortunately most critics of our system don't really understand the system. You have avoided this trap, and you offer constructive ideas for solving the problems, *using* the system to do so.

In this sense I like your suggestion that we need "a collective manipulation of the American system;" this is exactly what we need to do—not to do away with the system, but to manipulate it to serve socially constructive ends. We can do this if we use the strength of each segment of the system to do what it can best do.

Your suggestion that a "tested management program" is needed for those who administer businesses in the ghetto areas is another one I applaud. Generally speaking, I believe business should be concerned with the development and revitalization of the ghettos, but I believe business will be moved to effective action only if such developments are profitable for business. Business, as a profit-motivated machine, is a very difficult thing to gear to the solutions of social problems; but my own belief is that if we would identify a social goal and offer a profit incentive to solve it, business managers would flock to do the job. They would come up with highly original ideas to get the job done. And the cost to society would be low.

If we could unleash the power of the profit motive to serve social needs, that might well be the key to many of our social problems, including those of the ghettos.

A good deal of action is already being undertaken in this area, as you may know, much of it with little fanfare. Let me mention a few typical projects being carried out by businessmen:

—On the north side of Minneapolis, a ghetto area, Control Data Corporation is establishing a training institute in which employees will receive the same pay and benefits as employees in other areas, and be eligible for transfer to other plants.

—In the Roxbury section of Boston AVCO Corporation's new commercial printing plant is teaching highly paid skills to people previously considered "unemployable".

—In 1967, some 30 per cent of all new employees of Consolidated Edison, New York, were from minority groups, many resulting from the company's television show Opportunity Line". (In my company, 20 per cent of those hired last year were from minority groups.)

—Within five months of its formation, the New Detroit Committee, with the support of Detroit businessmen, had placed some 43,000 unskilled persons in jobs—and the New Detroit Committee, by the way, has done some outstanding work in encouraging and aiding the formation of businesses operated by and within the ghettos, including the technical aid, funds, and red-tape-cutting you mentioned.

—Similar programs are being carried on by such companies as General Telephone of Florida, Atlantic Richfield, McDonnell-Douglas, Standard Oil (New Jersey), and Aerojet General, whose Watts subsidiary, Watts Manufacturing Company, is fairly well known. Another is Threatt's Congaree Iron & Steel Company, South Carolina, the majority of whose Negro employees can neither read nor write; many, in fact, have prison records.

In related areas, the major automobile manufacturers are stepping up their franchising of Negro dealers, and some of the insurance companies and others are financing housing programs in the slums of Harlem, Philadelphia and other cities.

While this is by no means a complete conciliation it does indicate, I think, that we have a pretty good start on the kinds of projects you urge. Perhaps we should stress that it is *only* a start. We need to be doing much more than we are, but in the future I am sure we will look back and see that these projects were only the beginning.

We do need more emphasis on cooperation with ghetto leadership and with helping the local residents to set up their own going businesses, and I agree with you that we are moving too slowly in this direction.

What would help most of all, in my view, however, is to harness the profit motive to the solutions of these problems. That has been the key to American affluence throughout our history, and I think it is time to dust it off and use it once again for the solutions of the most pressing problems of our day.

Sincerely,

H. D. Doan, President,
The Dow Chemical Company

Dialogue

CAN THE CAMPUS COMMUNICATE WITH BUSINESS? IT CAN . . . AND DOES.

William Hill, a Sociology major at Tulane, opting for law, has synthesized a viewpoint and suggested a course of action for business involvement with the black American community. The Dow Chemical Company's president, H. D. Doan, has responded accordingly.

Similar exchanges are occurring between Russell DeYoung, Chairman of The Goodyear Tire & Rubber Company, and Robert W. Galvin, Chairman of Motorola Inc., respectively, with spokesmen from various campuses . . . a corporate-campus communications program that is exploring the role of business in our changing society . . . a Dialogue that is appearing in campus publications across the country throughout this academic year.

the unusual becomes routine

ITS WORLD-WIDE INTEREST in human health activities has led The Dow Chemical Company to the acquisition of a highly respected and successful clinical-diagnostic medical laboratory—Bio-Science Laboratories, located in Van Nuys, California. The original experienced management team continues to lead the organization.

Unlike most companies in the Dow organization, Bio-Science Laboratories' principal activity produces no products of any kind. Rather, the laboratory receives and analyzes specimens of human body fluids sent in by physicians, clinics, hospital laboratories and research institutions from all parts of the United States and from many foreign countries. The results of the analyses are reported back to the requesting physician or laboratory by mail, telephone, telegraph or direct teletypewriter transmission.

The test results supplied by Bio-Science Laboratories are utilized by the doctor to aid in the diagnosis of disease, to confirm a tentative diagnosis, and to follow therapy, thus offering more effective care to his patients. Bio-Science Laboratories offers over 600 different tests in the fields of clinical biochemistry, endocrinology, toxicology and micro-biology-immunology.

Most hospitals and physicians'

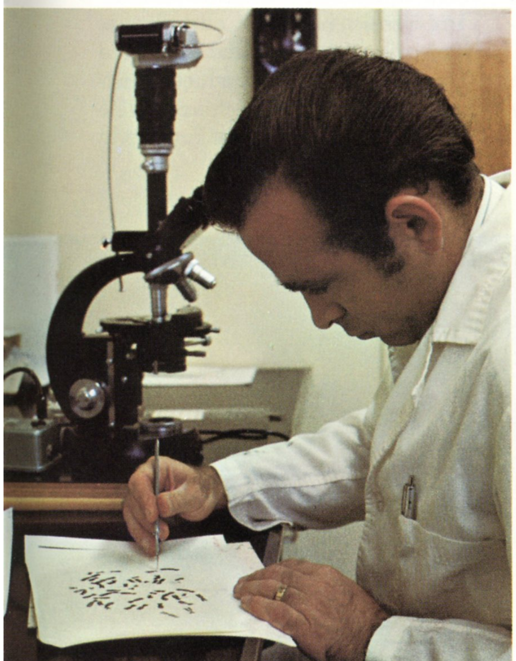
Dow's Bio-Science Laboratories Ranks High with the Medical Community

offices today are capable of doing many routine laboratory tests. But Bio-Science specializes in the unusual, more complex type of clinical diagnostic procedures —the kind that may be done nowhere else or the sort of test that requires special training, equipment or personnel. Such laboratory tests are done best when they are performed frequently and on a regular basis. Since Bio-Science services the entire country, what may be an unusual test for an individual hospital is very likely routine for this new associate of Dow.

Consequently, Bio-Science Laboratories lists many of the country's largest hospitals and most sophisticated research institutions among their clientele. Because of the large investment required in both equipment and personnel, an individual physician or hospital requiring sophisticated, complex tests will often prefer to "farm out" such work. As a result, Bio-Science Laboratories has become known as the "unusual laboratory for unusual tests."

Service, however, is an intangible commodity and the quality cannot always be judged objectively by the physician looking for an outside laboratory. The individual physician must rely on the reputation of a laboratory in the eyes of the medical community. This is where Bio-Science Laboratories excels. Because of the accuracy and reliability of the test results, the many technical articles published by members of the Bio-Science staff, and because every test situation is handled with "integrity" as the byword, Bio-Science Laboratories has gained a position of prominence and respect in the medical community.

Richard J. Henry, M. D., director of the laboratory, says, "Our first obligation is to the welfare of the patient. Handling every situation with integrity and in a



Technician (above) prepares analysis columns for thyroxine determination, a test useful in the study of thyroid function. Photo on opposite page shows technician checking results from automated test equipment.

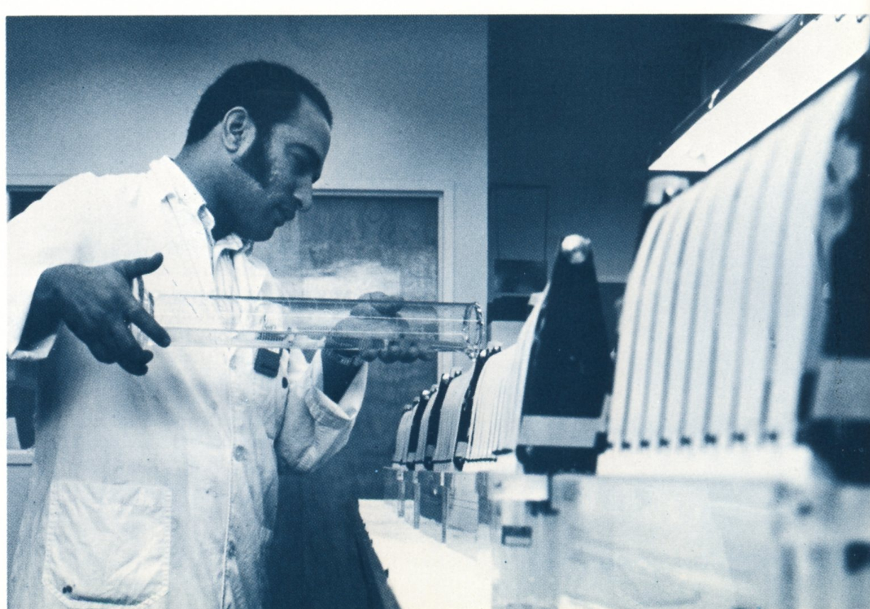
Technologist performs an unusual test in chromosome analysis. He is preparing a karyotype, which is a photograph of the chromosomes in a cell.

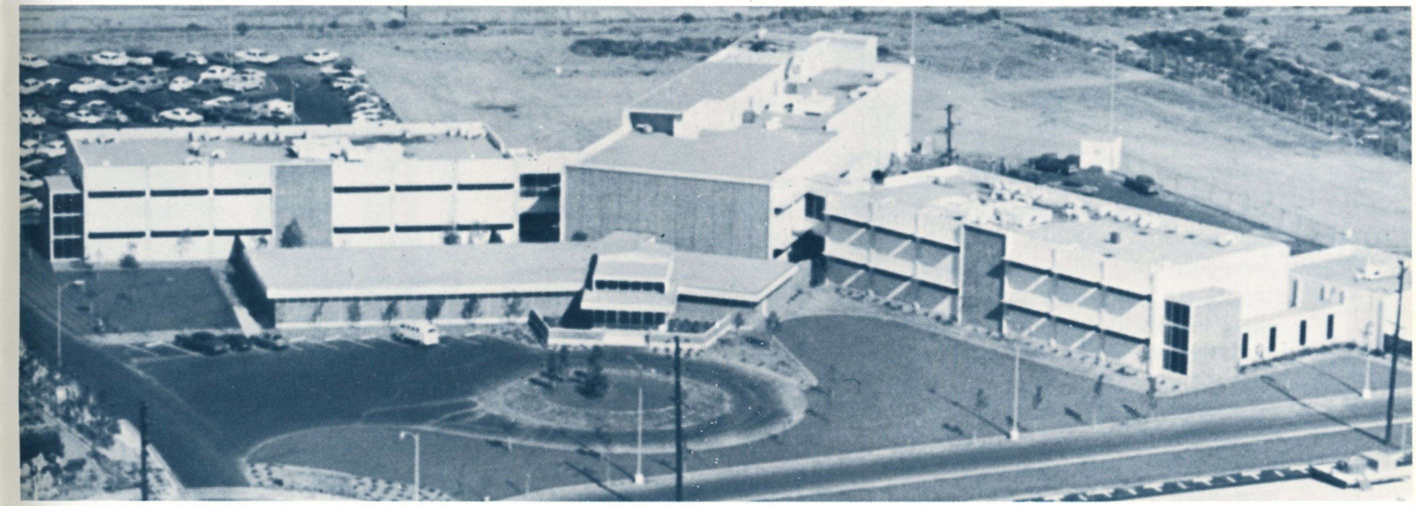
Directing the activities of Bio-Science Laboratories are: (l to r) Sam Berkman, Ph.D., president; Orville J. Golub, Ph.D., executive vice president; James W. Winkelman, M.D., assistant director; Norman D. Lee, Ph.D., assistant director, Branch Laboratories; and Richard J. Henry, M.D., director and secretary.

manner that will ultimately offer the most benefit to the patient is always uppermost in our minds." This formula for quality and integrity has enabled Bio-Science Laboratories to grow from a small group of individual scientists beginning in 1948 to a vigorous, diversified staff of over 450, including two M.D.'s and twenty-four Ph.D.'s. The laboratory is presently operating in a 73,000-square-foot facility in Van Nuys, California, and plans to add an additional 35,000 square feet by early 1970.

Through Bio-Science research and a variety of Dow skills, a series of blood chemistry test kits has also been developed. These kits enable doctors or their technical assistants to perform many of the simpler diagnostic tests right in their own office laboratories and still obtain reliable and accurate results. The kits, which also are finding increasing use in hospitals and clinics, are being produced and marketed by the Diagnostic Products Business of Dow Life Sciences. The tradename Diagnostest® refers to

The separation of proteins of blood is accomplished through a technique involving reverse electrophoresis (right).





components of the system.

The next step in the planned expansion of Bio-Science Laboratories is an organized network of regional laboratories around the country, all performing the same procedures with the same high capability of the parent laboratory. This will allow even faster and more personalized service to be offered to the medical profession in the various geographical areas. Branch laboratories are already operational in Beverly Hills, Calif., and Philadelphia, Pa.

Although Bio-Science is one of several units in the global Dow Life Sciences organization, it also has its own subsidiaries operating in a smaller orbit. In New York City Bio-Science acquired Photovolt Corporation, a respected and well-known manufacturer of scientific laboratory instruments used in medical, chemical, photographic and general industrial laboratories. This unit of Bio-Science supplies the instrumentation that is sold with the blood chemistry testing kits, evidence of synergism among Dow groups, where the combined action of the three is greater than the sum of the individual units.

In the Bay Area of Northern California they acquired Bio-Science Animal Laboratories and Horton's Laboratory Animals, Inc. These two groups breed and market mice, rats, guinea pigs and rabbits for research laboratories throughout the West and also sell animal cage supplies to the same clients. In addition, of course, they continually supply their parent company in Van Nuys with the animals they require for testing purposes.

As the revolution in biological knowledge progresses, the diagnostic testing laboratory will remain one of the central contributors, both because of the research carried out and because of the assistance offered in diagnosing the medical ills of man by ever-increasing parameters. Bio-Science Laboratories has been a part of that story for over 20 years and intends to play an important role in the years to come.

Blood components are separated in a procedure using column chromotography.

Quiet, But Still Heard

C. B. BRANCH

GETTING C. B. (BEN) BRANCH to sit long enough to extract an interview can, in itself, be considered a major accomplishment. An intensely loyal Dow man, Branch probably enjoys nothing better than talking about where the company was, where it is now and where it is going.

The real hang-up is finding him in his office long enough. As executive vice president and chief architect of the company's global operations, Branch can be counted upon to be away from the corporate headquarters in Midland, Michigan, almost as much as he is there. In fact, when Dow was presented with the Kirkpatrick Award for Management Achievement by Chemical Week magazine last autumn, Branch was following true to form: he was away in Japan on a business trip. The other two sides of the management triumvirate, President H. D. Doan and Board Chairman Carl A. Gerstacker accepted the award at a black tie dinner in New York while, at the same time, Branch was in Tokyo enjoying a tempura dinner with Japanese businessmen.

At 54, Branch is the senior man, in age, of the three-man group that is successfully running Dow. They have put together a workable organization, which, since the team was formed in 1962, has seen Dow's:

- Profits increase 80 per cent
- Profit margin rise from 7 to 10 per cent
- Per-share-earnings climb from $2.51 to $4.41.

Branch, at once, seems a reticent type, but with an easy grin. With the height and build of a football player, he recalls his early years in Omaha, Nebraska where he was born, and his undergraduate years at Western Reserve University in Cleveland. During his junior year he studied at Heidelberg University in Germany which may account for his fondness for the West German area where Dow has built and operates a plant at Greffern, maintains a sales office at Frankfurt and is building a new plant at Stade, near Hamburg.

Following his graduation in 1937 with a magna cum laude A.B. in chemistry, Branch took part in the student training course at Dow. He has been with the company since.

His climb through the Dow ranks has been steady. After the training period, he worked in the research department of the Cellulose Products Division then moved to Dow's Texas Division at Freeport where he became a plant superintendent. He returned to Midland as manager of the Coatings section of the Plastics Sales Department and spent three years as manager of Technical Service and Development. He became manager of the Plastics Department in 1952 and in 1958 he was elected to the Dow board of directors. The following year he became president of Dow Chemical International Limited, S.A. and Dow Chemical Inter-American Limited S.A., wholly-owned Dow subsidiaries. These groups were the forerunners of Dow Chemical Europe S.A. and the Latin American Area.

Now, as executive vice president, Branch is in charge of manufacturing, research, the product departments and international operations.

He is a member of the board of directors of Asahi-Dow Limited, Tokyo.

In his book, *The Dow Story*, author Don Whitehead noted "the year 1958 marked the beginning of a period of broad change in The Dow Chemical Company—change which was to influence the company's policies, organization, and philosophy of doing business."

When Branch was given the job that year of reorganizing the overseas operations, he had to relinquish his job as head of the important Plastics Department, then the fastest growing of all the company's departments.

Leland I. Doan, Dow president at the time, gave Branch "a blank check. You run the show."

Branch surrounded himself with a group of young managers, most with little overseas experience, but nevertheless eager to make their new assignment work.

In their favor was the fact that Europe's economy was getting stronger and there was a need for products and services which could be provided by Dow. During the first four years in Europe, Branch had committed some $200 million in capital investment while building plants in Greece, Holland, Germany and Italy.

Presently, Dow is building new plants in Korea, West Germany, Malaysia and Australia. During the last year, new facilities were placed in operation in France, Argentina and Mexico while existing plants were expanded in The Netherlands, Great Britain and Japan. Sales offices were opened in Taipei, Taiwan and Bangkok, Thailand.

Gerstacker, in *The Dow Story*, recalls that "Ben changed our whole approach to international operations. He was the kind of guy who said 'Here I go, follow me.'

"And he had some strong men around him who weren't afraid to go. Ben set a pattern and it wasn't long until other companies were reorganizing along the same lines. But Dow Chemical was the most aggressive of all."

The success of revamping the overseas operations can be readily seen in the increase of business. By the end of 1968, non-U.S. sales brought in 33 per cent of the company's money. This compares with 25 per cent in 1967 and with 16 per cent in 1959.

As a result of his success in the international area, Branch was named Dow's executive vice president in 1962 and joined with H. D. Doan and Gerstacker to bring a new team leadership to the Company.

In his capacity, Branch is still in charge of overseas manufacturing operations as well as those in the United States and Canada. He has definite ideas about where he wants Dow to be in the years ahead.

"I would like to see Dow obtain a good sales growth," he says. "At the same time, we must improve our profit margins. This can be done by improving our product mix or shifting our product mix, but the ultimate objective is to improve our *profit* mix and to grow at least 10 per cent per year in earnings per share."

Branch feels that Dow has the necessary strengths within its ranks to accomplish this goal.

"I think the greatest single company strength is Dow's willingness to give people as much freedom as possible to get things done. It's been expressed as a freedom to fail, so to speak. Also, we have been an extraordinarily ethical company. This has given us a standard with customers that is the envy of a lot of companies in the world. I honestly think we have the best people in the business, and I wouldn't trade our crew with anybody—bar none." he said, mentioning a few major industry competitors.

He feels strongly that Dow is the most innovative company in the world.

"Numerically," he says, "I don't think that there is anybody that's in the same class as Dow. Others may have had some bigger hits, but numerically, again, we are the most innovative."

Dow's marketing strength and skills, he feels, are second to none and in the products that are important to the company, the technology is superior.

Almost facetiously, he refers to the "mish-mash of organization" that Dow has always had.

"While nobody can make a case that it is on paper the most efficient, the communications it fosters results in the most effective kind of organization that I know of in business."

About the company's recent reorganization, when a U.S. Area was established, Branch feels that a higher degree of concentration will be achieved in what he calls the most profitable market in the world. Another important benefit, he feels, is that management can step back from the day-to-day-operation of the business. and concentrate more on thinking about where the company is going, how it should get there and the kind of people who will get it there.

There is little doubt that Branch is people-oriented. Although he possesses a subtle sense of humor, people agree that he isn't the light, glad-hander type.

His secretary of 14 years, Gertrude Welker, notes that he is extremely well-organized in his thinking and that he reads reports rapidly. With a touch of envy, people marvel at the fact that he can read one of Winston Churchill's books on World War II in one evening.

Fair in his dealings with people, he delegates responsibility and authority easily. He wants people to grab onto an assignment and—even if they make mistakes—carry it through to the end.

Branch was married to the former Shirley Marie Dasher in 1939 and, when reminded that this is their 30th wedding anniversary, remarked that it certainly has been an eventful 30 years. They are the parents of seven children, six girls and a boy.

An avid fisherman, Branch has a cabin in northern Michigan where he likes to retreat during the summer whenever it is possible. He enjoys the outdoors and is an earnest card player.

Ben Branch is the quiet man in the triumvirate that runs Dow. But the expansion moves he has initiated and the plans he has for the future of Dow speak thunderously in his behalf.

ZIPLOC®

A promising new consumer product, *Ziploc®* brand plastic food storage bags is currently being test-marketed in five cities in the United States. Made from polyethylene, *Ziploc* brand plastic bags feature a patented zipper-type closure, called the *Minigrip®* closure, that seals in freshness and flavor. The new bags are ideal for refrigerator and freezer food storage as well as for storage of non-food items. Research, production and marketing capabilities have led to this exciting product, one of 1,100 made by The Dow Chemical Company.

FROM: PUBLIC RELATIONS DEPARTMENT
The Dow Chemical Company
Midland, Michigan

FOR FURTHER INFORMATION
Contact: Jack Eadie
Phone: 517-636-0366
Midland, Michigan

The heat shield on the Apollo 11 spacecraft is designed to protect the three-man crew taking the most historic step to date in man's march toward the stars. On the way home from the moon Astronauts Neil A. Armstrong, Michael Collins and Edwin E. Aldrin (left to right) will re-enter the earth's atmosphere at 25,000 miles per hour, depending on the heat shield for protection against searing 5,000 degree temperatures.

# # #

FROM: PUBLIC RELATIONS DEPARTMENT
The Dow Chemical Company
Midland, Michigan

FOR FURTHER INFORMATION
Contact: Jack Eadie
Phone: 517-636-0366
Midland, Michigan

Scorched heat shield is visible on the Apollo 7 command module as it is hoisted aboard the USS Essex near Bermuda in October 1968. The spacecraft carried Astronauts Walter M. Schirra Jr., Donn F. Eisele and Walter Cunningham on an 11-day orbital flight, designed to verify Apollo equipment for future manned lunar voyages such as the historic mission taking men to the moon and back.

# # #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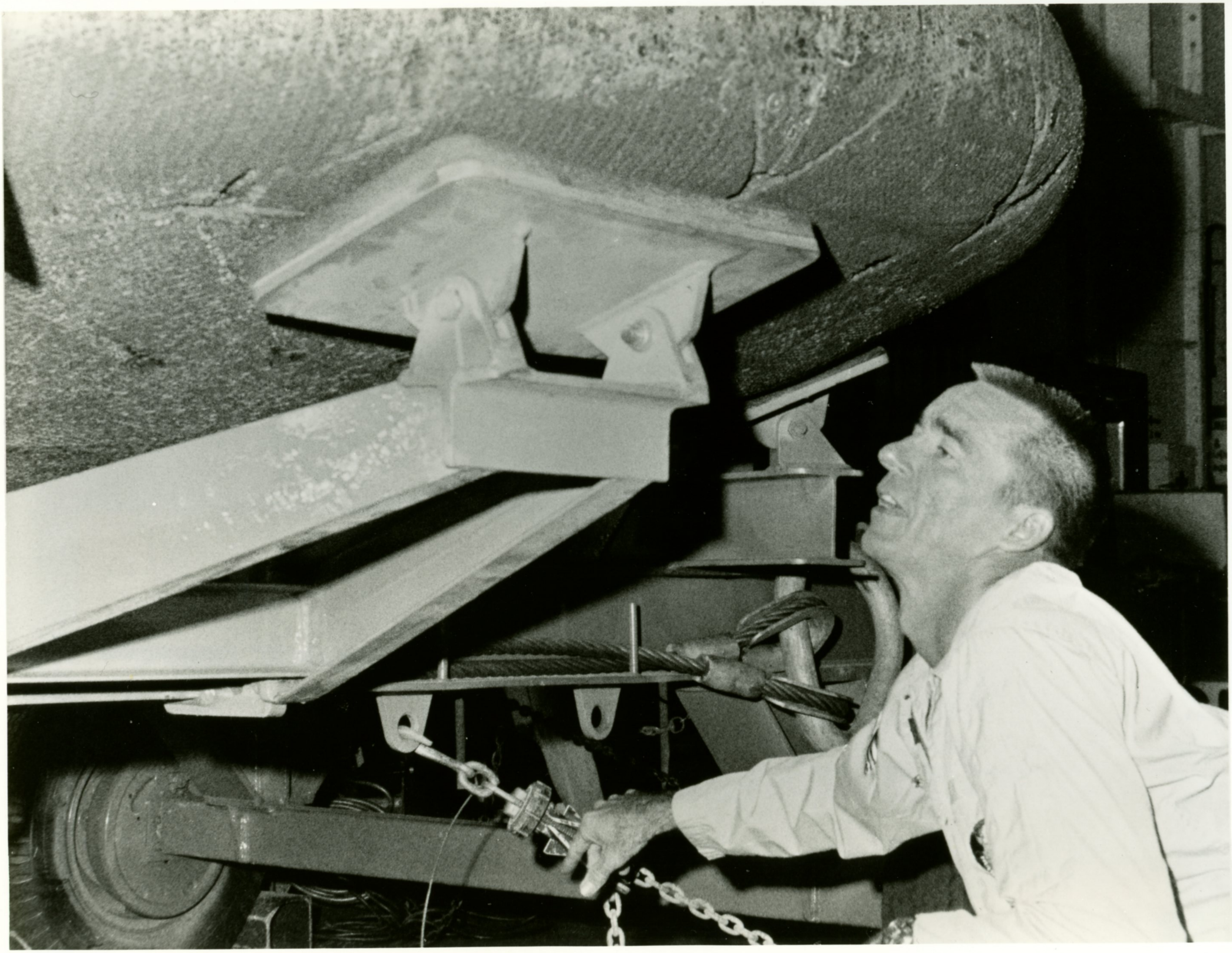
FROM: PUBLIC RELATIONS DEPARTMENT
The Dow Chemical Company
Midland, Michigan

FOR FURTHER INFORMATION
Contact: Jack Eadie
Phone: 517-636-0366
Midland, Michigan

1266A66 - An ablative material is injected into each honeycomb cell of the Apollo 11 spacecraft heat shield to protect astronauts and their vehicle from the searing temperatures. D.E.N. 438 epoxy novolac, a product of The Dow Chemical Company, is the basis of this material. Avco Research and Development engineers are shown injecting the ablative material into the blunt aft end of the spacecraft.

# # #



FROM: PUBLIC RELATIONS DEPARTMENT
The Dow Chemical Company
Midland, Michigan

FOR FURTHER INFORMATION
Contact: Jack Eadie
Phone: 517-636-0366
Midland, Michigan

Following the Apollo 7 mission, Astronaut Walter Cunningham examined the scorched heat shield on the underside of the spacecraft which carried him, Walter M. Schirra Jr. and Donn F. Eisele safely home from their 11-day earth orbital flight.

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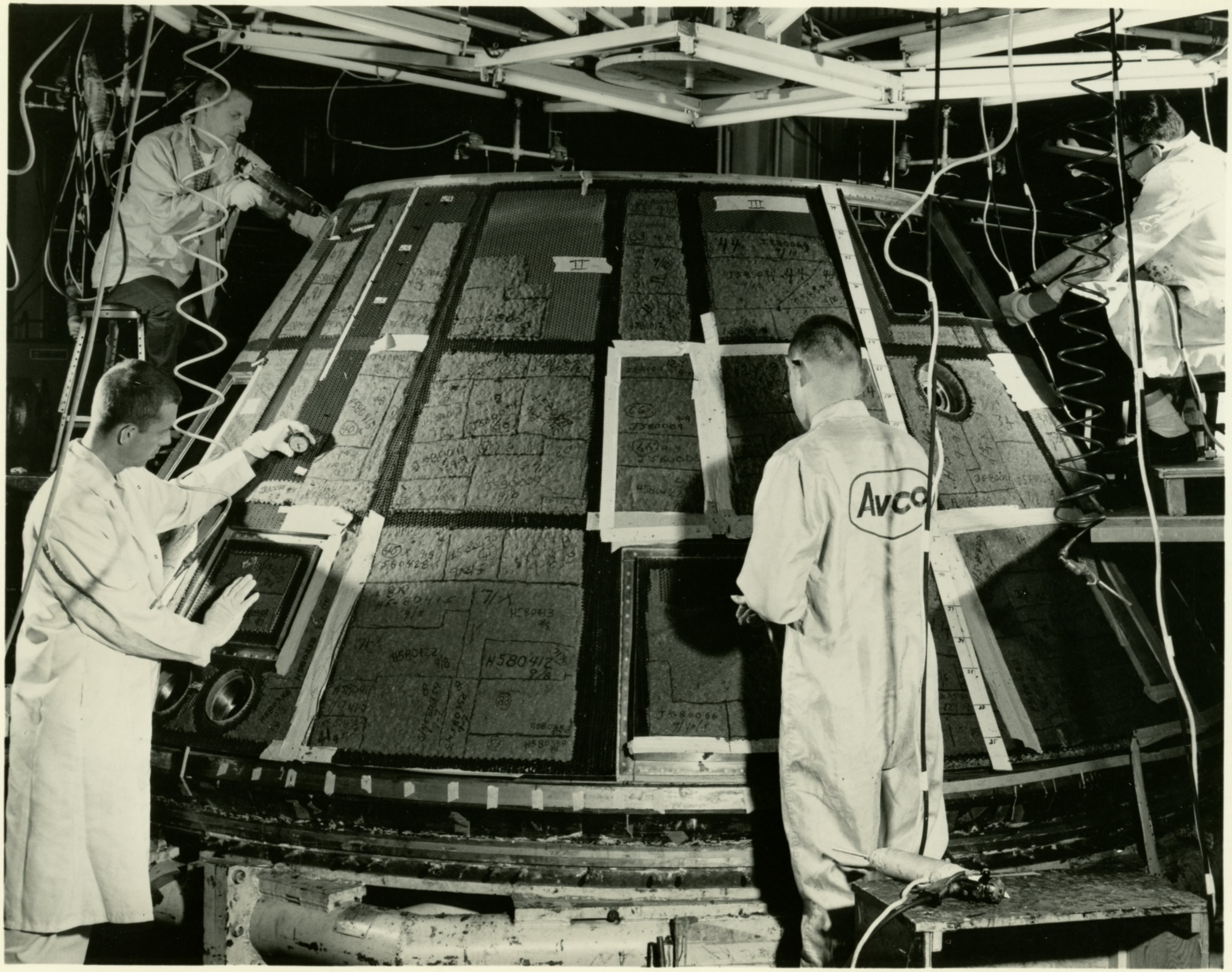
AVCO

FROM: PUBLIC RELATIONS DEPARTMENT
The Dow Chemical Company
Midland, Michigan

FOR FURTHER INFORMATION
Contact: Jack Eadie
Phone: 517-636-0366
Midland, Michigan

1230A66 -- Special injection guns, containing heating elements, were developed to inject the ablative material developed by Dow and fabricated on the spacecraft by Avco. Every inch of each section is then X-rayed. Severe conditions which Apollo will face make it necessary to cover the entire module with ablative material.

# # #


LESLIE SWANK

FROM: PUBLIC RELATIONS DEPARTMENT
The Dow Chemical Company
Midland, Michigan

FOR FURTHER INFORMATION
Contact: Jack Eadie
Phone: 517-636-0366
Midland, Michigan

1132A66 -- As U.S. astronauts re-enter the earth's atmosphere on their return from the moon, temperatures outside their Apollo vehicle will be near a mark of 5,000 degrees F.

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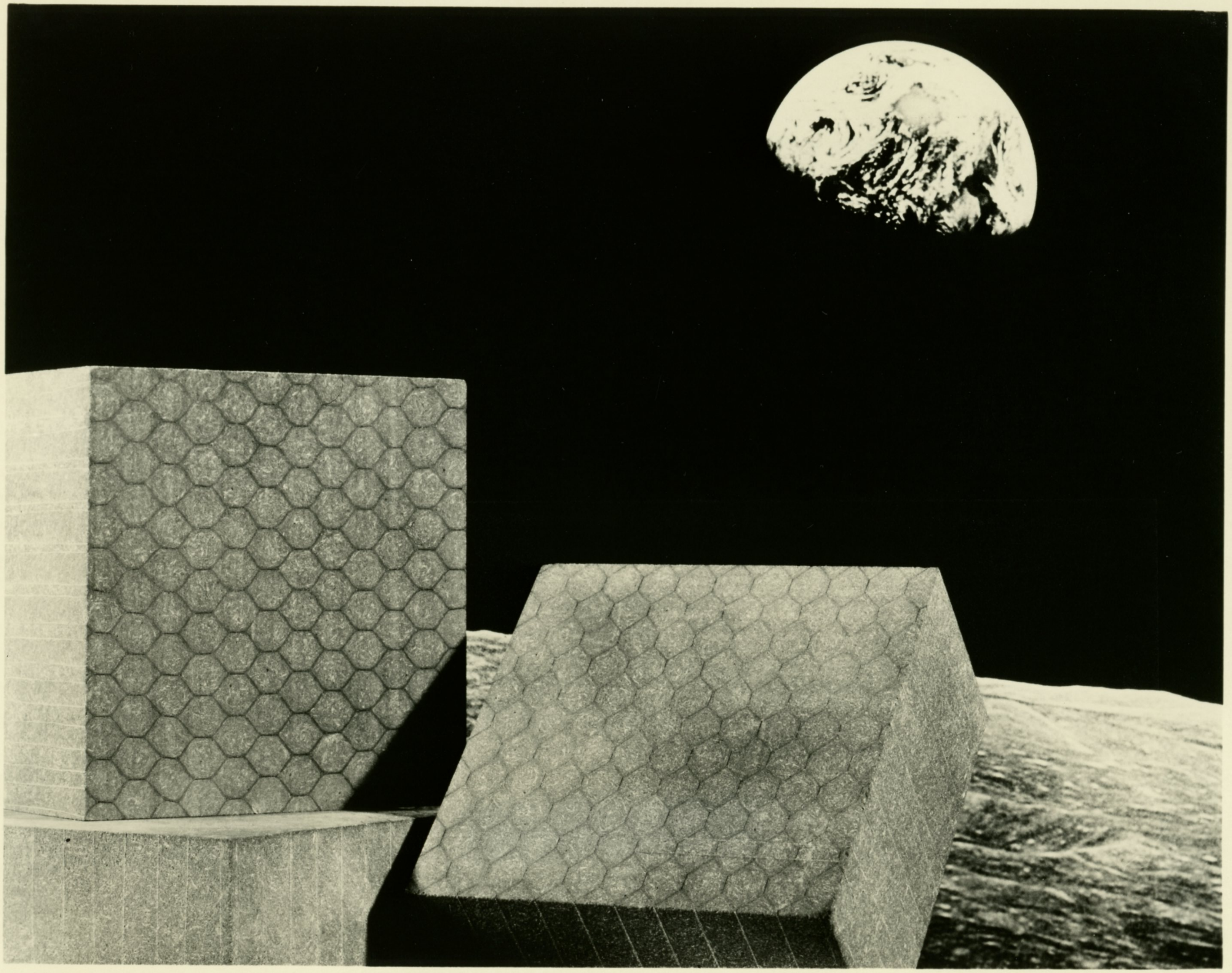

FROM: PUBLIC RELATIONS DEPARTMENT
The Dow Chemical Company
Midland, Michigan

FOR FURTHER INFORMATION
Contact: Jack Eadie
Phone: 517-636-0366
Midland, Michigan

4267B69 -- A safe ride home to that familiar planet in the distance is assured by the ablative heat shield protecting the Apollo 11 spacecraft during re-entry. Sample blocks of the ablative material, containing epoxy novolac resin, a product of The Dow Chemical Company and trademarked D.E.N. 438, are shown in foreground. The samples were provided by Avco Corporation, fabricator of heat shield for Project Apollo spacecraft.

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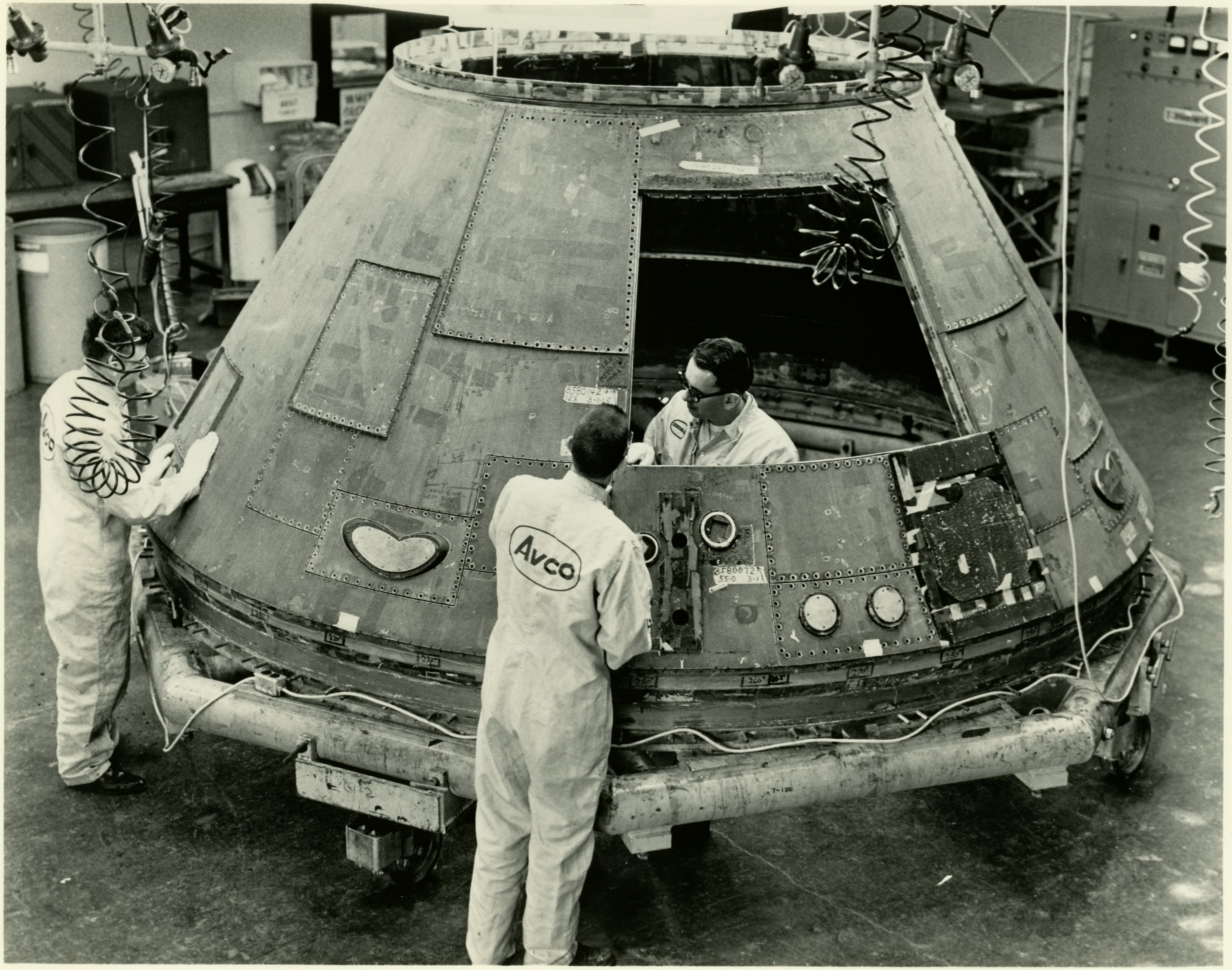
4267B69


Avco

FROM: PUBLIC RELATIONS DEPARTMENT
The Dow Chemical Company
Midland, Michigan

FOR FURTHER INFORMATION
Contact: Jack Eadie
Phone: 517-636-0366
Midland, Michigan

1229A 66 -- The crew compartment of the Apollo command module is inspected by Avco engineers before a honeycomb matrix of glass fiber is bonded to each section.

# # #

1229A66

THE DOW CHEMICAL COMPANY
Background Information

In 31 production locations throughout the United States, brightly-painted towers and miles of varicolored pipes symbolize chemistry at work in plants of The Dow Chemical Company.

Abroad, too, Dow's corporate trademark, the Dow diamond, is steadily gaining recognition as the company expands in the countries of the free world.

Today's global operations reflect tremendous growth over the 72 years of the company's existence. It all came from a humble beginning. An ancient sea and a new idea gave Dow its start.

Remnants of the sea, rich in chemical brines, lie deep under the flatlands of Midland, Michigan. To a young chemist named Herbert Henry Dow the commonplace brine meant opportunity in chemistry, which, as the 19th century drew to a close, was gradually emerging as a significant industry.

As a student chemist, Dow had discovered a new electrolytic process for extracting chemicals from brine. At Midland, in 1890, he rented a barn, hooked up a homemade rope drive from the steam engine of a flour mill, reactivated an idle brine well nearby, and -- in short -- proved that his process worked.

-more-

When World War II came and natural rubber supplies were cut off, the company was ready with the only commercial production of styrene, one of the two major components of synthetic rubber. Dow built and operated two large styrene plants for the United States government and a third for the Canadian government.

It was at this time that the company first used the Dow-developed process of extracting magnesium from sea water. It built and operated a big sea water magnesium plant for the government and jointly built and operated another such plant with the government. A third facility made use of underground brine for magnesium production.

From the common materials -- brine, petroleum, salt and air -- found in nature, then, has come a growing line of products. The company lists more than 1,100. Chemicals and metals account for 50 per cent of total sales; plastics and packaging, 32 per cent; and pharmaceutical, agricultural and consumer products, 18 per cent.

Over its 72 years, Dow has had five presidents. Albert E. Convers, a Cleveland manufacturer, served as president until 1918 and Herbert Dow served as general manager. Dow became president in 1918. After Herbert Dow's death in 1930, his son, Dr. Willard H. Dow, was made president and guided the company through 20 years of successful growth. Willard Dow died in a plane crash in 1949, and Dr. Leland I. Doan, then vice president and director of sales, was elected to the presidency.

-more-

Under Dr. Doan's leadership the company carried on an aggressive research program and became one of the most rapidly expanding of the major chemical companies. In 1962, Herbert D. Doan, grandson of the company founder, became Dow president. The younger Doan had been executive vice president since 1960. Dr. Leland I. Doan continues to be active in company affairs as chairman of the executive committee of the board of directors.

From 1948 through 1968, Dow's annual sales rose from $170.7 million to $1,652.5 million. Over that period the company invested more than $1.5 billion in new plants and facilities. Its payroll rose from 26,600 to 47,400 employees.

Dow people ascribe the company's growth to its traditional "will to progress." Teamwork involving personnel in research, production, technical service and development, sales, and finance has been a significant factor in Dow's rise to prominence as a leader among the world's chemical companies.

Early in his career Herbert Dow set the pattern for achievement. His business philosophy was one of practical action. He put it this way: "If you can't do a thing better than it's already being done, why do it?"

This is still the pervading philosophy as Dow moves forward in its eighth decade.

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Some Significant Dow Achievements

Electrolytic production of bromine, chlorine and caustic soda

Commercial synthesis of indigo

Commercial synthesis of phenol from chlorobenzene

Electrolytic production of magnesium

Development of magnesium alloys and fabricating techniques

Extraction of bromine from sea water

Production of iodine from natural brines

Production of styrene and polystyrene

Production of saran and development from it of films, filaments and fibers

Extraction of metallic magnesium from sea water

Development and production of synthetic latexes

Synthesis of essential amino acids

Operation of first commercial-size plant using atomic energy as a catalyst in a chemical production process

Production of agricultural chemicals, herbicides, insecticides, etc.

Production of foamed plastics

Development of "Dowetch" photoengraving process

Development of methoxyflurane, a non-flammable anesthetic

Development of water and waste treatment chemicals

Industrial toxicology research

Development of Lirugen measles vaccine

-more-

THE DOW CHEMICAL COMPANY

Corporate Headquarters in Midland, Michigan

Dow World-Wide Operations

Dow Chemical A.G., Zurich, Switzerland - finances overseas operations

Dow Chemical N.V., Curacao, Netherlands Antilles - handles financial operations in underdeveloped areas

Dow Chemical Overseas Capital Corporation, Midland, Michigan - lends capital outside the United States

Life Sciences Department, Midland, Michigan

Bio-Science Laboratories, Los Angeles, California - specialized clinical testing laboratories

Gruppo Lepetit S.p.A., Milano, Italy - Italian pharmaceutical firm with world-wide operations

Human Health, Indianapolis, Indiana, Operations - ethical pharmaceuticals, Diagnostic products

Laboratorios Industriales Farmaceuticos Ecuatorianos (LIFE) Quito, Ecuador - veterinary and human pharmaceuticals

St. Croix, Virgin Islands - human health products

U.S. AREA

Sales Offices:

Atlanta, Georgia
Baton Rouge, Louisiana
Boston, Massachusetts
Buffalo, New York
Camden Office (Moorestown, N.J.)
Charlotte, North Carolina
Chicago, Illinois
Cincinnati, Ohio
Cleveland, Ohio
Dallas, Texas
Detroit, Michigan
Houston, Texas
Indianapolis, Indiana
Kansas City, Missouri
Los Angeles, California
Minneapolis, Minnesota
New York, New York
Pittsburgh, Pennsylvania
Saddle Brook, New Jersey
St. Louis, Missouri
San Francisco, California
Seattle, Washington

-more-

Divisions and Plants:

Bay Refining Company Division, Bay City, Michigan - products from petroleum refining

Brazos Oil & Gas Company Division, Houston, Texas - headquarters - oil and gas

Cape Girardeau, Missouri - building panels

Catalytic-Dow, Titusville, Florida - joint venture serving the aerospace industry

Dalton Plant, Dalton, Georgia - latex

Dow Chemical Financial Corp., Chicago, Illinois and Midland, Michigan - financing

Dow Industrial Service Division, Midland, Michigan - headquarters - chemical cleaning and conditioning of industrial equipment; services and products in municipal and industrial waste and water treatment areas

Dowell Division, Tulsa, Oklahoma - headquarters - servicing of oil and gas wells

Louisiana Division, Plaquemine, Louisiana - chemicals, plastics

Madison Plant, Madison, Illinois - magnesium alloys, magnesium, aluminum and other metals in rolled and extruded shapes

Magnolia Plant, Magnolia, Arkansas - bromine, plastics

Midland Division, Midland, Michigan - chemicals, plastics

Allyn's Point Plant, Gales Ferry, Connecticut - plastics

Bay City Plants, Bay City, Michigan - petrochemicals and plastics

Hanging Rock Plant, Ironton, Ohio - plastics

Ludington Plant, Ludington, Michigan - chemicals

Riverside Plant, Pevely, Missouri - plastics

Royersford Dorvon Operations, Royersford, Pa., - polystyrene foam

Shreveport Dorvon Operations, Shreveport, La., - polystyrene foam

-more-

Minnesota Explosives Plant, Biwabik, Minnesota -- explosives

Oyster Creek Division, Oyster Creek, Texas - plastics

Packaging Department Manufacturing, Cleveland, Ohio - headquarters

Carteret, New Jersey, Plant - meat trays

Cleveland Plants - transparent packaging; laminated and extruded products from plastic films; metallic yarns

Findlay, Ohio, Plant - polyethylene film

Fresno, California, Plant - polyethylene film

Honolulu, Hawaii, Plant - polyethylene film

Newark, Ohio, Plant - plastic film (under construction)

Precision Fabrication Services, Denver, Colorado - precision machine parts and components

Rocky Flats Division, Rocky Flats, Colorado - manufacturing in government-owned plant for Atomic Energy Commission

Russellville Plant, Russellville, Ark., - aluminum extrusion plant

Texas Division, Freeport, Texas - chemicals, plastics, magnesium

Western Division, San Francisco, California - general offices

Kalama, Washington, Plant - phenol

Pittsburg, California, Plant - chemicals, plastics

Torrance, California, Plant - plastics

<u>Partly-owned Companies</u>:

Dolco Packaging Corp. (jointly owned by Dow and Olson Brothers, Inc.), headquarters at North Hollywood, California, plants at Pico Rivera, California; Wenatchee, Washington, and Lawrenceville, Georgia - foamed polystyrene sheet containers

Dow Badische Company, Williamsburg, Virginia - headquarters - (jointly owned by Dow and BASF Overzee N.V.) - synthetic textile fibers

Anderson, North Carolina, Plant - nylon fibers

Freeport, Texas - acrylic acid and acrylic esters, caprolactum and butanol

-more-

Dow Corning Corporation, Midland, Michigan (jointly owned by Dow and Corning Glass Works)

Carrollton, Kentucky, Plant - basic silicon manufacturing

Elizabethtown, Kentucky, Plant - manufacture of silicon rubber sealants

Greensboro, North Carolina, Plant - consumer goods made of silicones

Hemlock, Michigan, Plant - manufacture of medical products and hyper-pure silicon

Midland, Michigan, Plant - silicon products

Stamford, Connecticut, Plant - (Alpha - Molykote Plant) - mfgs. equipment for lubrication and specialty lubricants

Trumbull, Connecticut, Plant - silicon rubber compounding

Ethyl-Dow Chemical Company, Freeport, Texas (jointly owned by Dow and Ethyl Corporation) - ethylene dibromide

The Kartridg Pak Company, Davenport, Iowa (jointly owned by Dow and Oscar Mayer & Company) - packaging equipment

Solar Salt Company, Salt Lake City, Utah - salt

Dow Chemical of Canada, Ltd.

Headquarters in Sarnia, Ontario

Sales Offices:

Atlantic Office - St. John, New Brunswick
Calgary Office - Calgary, Alberta
Montreal Office - Montreal, Quebec
Sarnia Office - Sarnia, Ontario
Toronto Office - Toronto, Ontario
Vancouver Office - Vancouver, British Columbia
Winnipeg Office - Winnipeg, Manitoba

-more-

Production Operations:

Calgary, Alberta - Dowell of Canada - services oil and gas wells and industrial equipment

Don Mills, Ontario, Plant - human health products

Edmonton, Alberta, Plant - beadboard

Fort Saskatchewan, Alberta, Plant - chemicals

Fort William, Ontario, Plant - caustic soda, chlorine, chlorine dioxide

Ladner, British Columbia, Plant - phenol, benzoic acid

Montreal, Quebec, Plants - manufactures flexible packaging, rigid containers from plastic films, paper and foil

Sarnia, Ontario, Plant - chemicals and plastics

Toronto, Ontario, Plants - medical and animal health products, flexible packaging, rigid containers, Styrofoam polystyrene foam

Dow Chemical Europe S.A.

Headquarters in Zurich, Switzerland

Sales Offices:

Athens, Greece
Brussels, Belgium
Cape Town, Durban and Johannesburg, South Africa
Copenhagen, Denmark
Frankfurt, Germany
London and Wimslow, England
Madrid, Spain
Milan, Italy
Oslo, Norway
Paris, France
Rotterdam and Terneuzen, The Netherlands
Stockholm, Sweden
Vienna, Austria
Zurich, Switzerland

-more-

Production Operations:

Distrene Limited, South Wales, England - produces polystyrene

Dow Chemical Company (U.K.) Limited, Norfolk, England - produces chemicals, plastics and latex

Dow Chemical France, Drusenheim - animal health products

Dow Chemical GmbH, Frankfurt, W. Germany - Styrofoam expanded polystyrene, latex and Separan flocculant

Dow Chemical (Hellas) A.E., Athens, Greece - manufactures polystyrene plastic

Dow Chemical (Nederland) N.V., Rotterdam-Botlek, The Netherlands - production of Saran resins and latex

Dow Chemical (Nederland) N.V., Terneuzen, The Netherlands - production of broad line of chemicals and plastics

Dow Chemical S.p.A., Livorno, Italy - production of polystyrene plastic and latex

Service Operations:

Dow Banking Corporation - - Zurich, Switzerland - specialized banking services

Dow Chemical (Europe) S.A. - management and technical services to Dow companies in Europe and Africa

Dow Chemical Belgium - Brussels, Belgium - represents Dow in Belgium and Luxembourg

European Partly-owned Companies (main offices):

Adela Investment Company S.A., Luxembourg - Provides capital investments in Latin America

Bankierskantoor Mendes Gans N.V., Amsterdam, The Netherlands - commercial investment bank

Compagnie des Services Dowell Schlumberger, Paris, France - perform directly or through subsidiaries all Dowell services and Johnson Testers drill stem services in overseas locations (particularly Europe and Africa)

-more-

Dowell Schlumberger Corporation, London, England - perform directly or through subsidiaries all Dowell services and Johnson Testers drill stem services in overseas locations

Dow-Unquinesa, S.A., Bilbao, Spain - plants produce chemicals and plastics

Envases y Recubrimientos, S.A. (E.R.S.A.), Madrid, Spain - produces polyethylene and other flexible packaging materials

Lurex N.V., Amsterdam, The Netherlands - metallic yarn

Phrix-Werke A.G., Hamburg, Germany - synthetic fibers

Plastichimie S.A., Paris, France - polystyrene and Saran resins

Dow Chemical Latin America

Headquarters in Coral Gables, Florida

Sales Offices:

Barranquilla, Bogota, Bucamaranga, Cali and Medellin, Colombia
Buenos Aires, Argentina
Caracas, Venezuela
Lima, Peru
Mexico City and Monterrey, Mexico
Quito, Ecuador
Rio de Janeiro and Sao Paulo, Brazil
San Juan, Puerto Rico
San Salvador, El Salvador
Santiago, Chile

Production Operations:

Dow Colombiana, S.A. Cartagena, Colombia - manufactures polystyrene

Dow Quimica Argentina, S.A. - Buenos Aires, Argentina - chemicals

Dow Quimica de Colombia, S.A., Bogota, Colombia - chemicals, plastics and pharmaceuticals

La Domincia, S.A. de C.V., Mexico City, Mexico - mines fluorspar; manufactures chemicals, aspirin and pharmaceuticals

Latin American Partly-owned Companies (main offices):

Atanor Compania Nacional Para La Industria Quimica S.A.M., Buenos Aires, Argentina - production of various chemical and herbicide products

Cloroquim S.A.I.C., Sao Paulo, Brazil - production of carbon-tetrachloride

Dowell Schlumberger (Eastern) Inc., Panama - oil well services in Tunisia, Libya, Holland and Venezuela

Dowell Schlumberger (Western) S.A., Panama - oil well services in Venezuela and Middle East

Dowell Services Trinidad S.A., Panama - oil well services in Trinidad

Dowell Schlumberger Argentina Sociedad Anonima de Mineria, Buenos Aires, Argentina - oil well services and mining activities in Argentina

Petroquimica Dow S.A. (PETRODOW), Santiago, Chile - manufacture and sale of plastics in Chile

Poliolefinas Colombianas S.A. (POLICOLSA), Bogota, Colombia - polyethylene

Dow Chemical Pacific

Headquarters in Hong Kong, B.C.C.

Sales Offices:

Auckland, New Zealand
Bangkok, Thailand
Brisbane, Adelaide, Melbourne and Sydney, Australia
Hong Kong, B.C.C
Kuala Lumpur, Malaysia
Manila, Philippines
New Delhi, India
Osaka and Tokyo, Japan
Seoul, Korea
Taipei, Taiwan
New York and San Francisco, U.S.A.

Production Operations:

Dow Chemical (Australia) Limited - Victoria and New South Wales, Australia - production of polystyrene, caustic and chlorine

Pacific Chemicals Berhad, Kuala Lumpur, Malaysia - agricultural chemicals

Dow Pacific Partly-owned Companies:

Asahi-Dow, Limited, Tokyo, Suzuka-shi City, Mizushima, Nobeoka-shi and Kawasaki, Japan - production of plastics and synthetic fibers

Austral-Pacific Fertilizers Limited, Brisbane, Australia - produces fertilizers and intermediate products

Ivon Watkins-Dow Limited, New Plymouth, New Zealand - manufactures agricultural chemicals with other chemical activities

Polychem Limited, Bombay, India - production of polystyrene plastics in India

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Dow News Release

FOR FURTHER INFORMATION
Contact: Jack Eadie
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Midland, Michigan

FOR IMMEDIATE RELEASE

EPOXY NOVOLAC RESIN IN HEAT SHIELD
ASSURES APOLLO 11 A SAFE RIDE HOME

When the Apollo 11 spacecraft streaks homeward from the moon, it will plunge American astronauts toward the earth at 25,000 miles an hour with temperatures on the vehicle's surface soaring above 5,000 degrees fahrenheit.

Enveloped in high temperature gases, the spacecraft will be in the final stages of the longest step thus far in man's march toward the stars.

The Dow Chemical Company, in cooperation with other industries working for the success of the United States' space program, has played a prominent role in assuring the safety of the men who have climaxed this gigantic effort.

Among Dow's many contributions to the space program has been the development of the basic material in the Apollo ablative heat shield, a unique epoxy resin, known as epoxy novolac and trademarked D.E.N. 438.

Like most materials, Dow Epoxy Novolac cannot withstand 5,000-degree temperatures. But as formulated and fabricated on the spacecraft by Avco Corporation, the heat shield chars as it burns -- similar to the burning of a log of wood -- thus protecting the spacecraft and the astronauts from the searing temperatures.

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The heat shield was previously subjected to rigid testing under re-entry conditions in unmanned flight operations during the early stages of Project Apollo.

In developing the heat shield, Avco's Research and Development Division required D.E.N. 438 because the Apollo spacecraft would encounter conditions far more severe than those in previous segments of the space program. For instance:

-- A re-entry temperature of 5,000 degrees compared with 3,000 degrees for re-entry of the Gemini spacecraft which served as one of several stages of a program leading to the Apollo missions.

-- A re-entry speed of 25,000 miles an hour instead of 17,500, requiring a two-phase descent with an intermediate leveling-off stage.

-- Exposure to the extremely high temperatures for approximately 20 minutes, instead of eight or nine minutes.

-- The necessity for encasing the entire command module in ablator, rather than just the blunt aft end. Even the pointed tip will encounter temperatures near 2,000 degrees.

In essence, an ablative material is simply one that dissipates heat by oxidizing. On re-entry from a space mission, it continues burning until reduced speed has decreased heat levels on the spacecraft's external surfaces.

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An important characteristic of the epoxy-based ablative material is that it is an outstanding insulator. Encasing the entire command module, it will keep the stainless steel frame from heating higher than 600 degrees fahrenheit, even though the shield is only 1.5 to 3 inches thick.

The first epoxy novolac was developed by Dow before scientists had delved deeply into the problem of how to safely re-enter the earth's atmosphere.

Avco's Research and Development Division at Wilmington, Mass., was, in fact, organized specifically to develop re-entry vehicles for intercontinental ballistic missiles. The work on the spacecraft heat shield incorporating Dow Epoxy Novolac is an outgrowth of that experience.

Here in brief is what went into the manufacture of the heat shield:

Fabrication of the Apollo heat shield started with a fiber glass honeycomb shaped to fit the spacecraft and machined to precise dimensions. This is bonded to the stainless steel frame -- with an adhesive based on another Dow epoxy resin.

The ablative material is injected into each of more than 370,000 cells. Curing, or hardening, of the material is accomplished in huge ovens at 250 degrees fahrenheit.

Eventually, after many steps of X-ray and dimensional inspection, the material is coated with a white, reflective paint.

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The ablative heat shields first used on missiles were metal, and by comparison they were monstrously heavy. In the Apollo heat shield incorporating the Dow material, additional weight is saved and the insulating properties are improved, by mixing the epoxy resin with silica fibers and a powdery plastic substance known as micro-balloons.

"We never have deviated from Dow Epoxy Novolac in our work on Apollo ablative heat shields," says Dr. Coy L. Huffine, Avco Research and Development project manager for heat shield manufacturing. "We have found it is much superior to other materials in the stability of its charring. When it burns and chars, it sticks together tenaciously."

D.E.N. 438, Dow Epoxy Novolac, is described by Dow as combining in one molecule "the thermal stability of the phenol backbone and the reactivity and versatility of an epoxy."

This is accomplished by the epoxidation of a novolac-type base resin," says R. D. Visger, marketing manager of Dow's Designed Products Department. "As a result of its multi-epoxy functionality, it produces a higher cross-linked system with better elevated temperature performance than the established bisphenol-based resins," Visger said.

Other applications for Dow Epoxy Novolac include its use in electrical grade laminates, self-extinguishing varnishes and encapsulation materials.

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DOW
Information from Dow

FOR FURTHER INFORMATION
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Midland, Michigan

DOW A LONG-TIME CONTRIBUTOR TO U.S.
AEROSPACE AND MOON LANDING EFFORTS

The Dow Chemical Company has been a long-time supplier of products and services to the aeronautical and aerospace industries. These products and services reflect the broad and complex nature of the company's business, and the technological capabilities developed in Dow laboratories and manufacturing plants throughout the world.

As one of the first, and at times the only producer of magnesium metal in the U.S., Dow has supplied millions of pounds of this light metal for use in both military and commercial aircraft and spacecraft.

Many of the company's solvents, chemicals and plastics have found innumerable direct and indirect applications associated with flight. And in the past decade particularly, Dow has placed increasing emphasis on research, development and specialized services relating to the aeronautics and aerospace fields.

A member of the large family of Dow plastics is playing a major role in one of the most dramatic phases of the Apollo flights -- the re-entry phase (see accompanying news release).

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This material is one of a series of Dow epoxy resins and the first epoxy novolac, to use its scientific designation. Epoxy novolacs are special multi-functional resins for all uses where maximum chemical resistance or heat resistance is required.

While epoxy resins were not developed specifically for aeronautical or aerospace use, they are being applied in a variety of applications in these industries. Dow Epoxy Resin has been used by United Technology Center for the binder in the solid propellant in the strap-on booster motors of the Titan 3-C rocket. Dow Epoxy Resins perform the same function in the huge, solid-propellant rockets developed by Thiokol Chemical Corporation and Aerojet-General Corporation, and also in Minuteman missiles.

At Launch Complex 39, firebricks in the flame trench are adhered to concrete walls with an epoxy mortar formulation produced by Protective Coatings, Inc. using Dow-produced epoxies. A thin layer -- 0.015 inch -- of mortar holds the bricks in place despite the pulsating vibrations and heat at lift-off.

Other Dow epoxy resin uses are in coatings for painting missile structures at the Cape, and in nonskid surfaces for the escape tunnels in launch complexes.

A pipeline system for transporting gaseous nitrogen from storage tanks to the Project Apollo launch complex was fabricated from 14-inch aluminum pipe, extruded at the Madison, Ill., Plant of The Dow Chemical Company. The piping was produced on a 14,000-ton press, one of the four largest in the free world.

Dow is the world leader in the development and production of chlorinated solvents used for cleaning, and the company supplies a large share of the hundreds of thousands of gallons consumed in space work and by such aerospace leaders as Lockheed and North American Aviation. Since space systems must be ultra-clean, a material such as Dowclene WR solvent, used under NASA process specification 164, is put to work all along the line from factories manufacturing tiny components to the launch complexes.

Dow solvents such as trichloroethylene, Chlorothene VG and Chlorothene NU are used in cleaning operations in many other phases of flight-related industries, including electronic components and assemblies, inertial guidance systems, pressure systems, hydraulic systems and precision bearings. Solvents are suitable for cold cleaning, ultrasonic cleaning and vapor degreasing.

Dow experience in bromine chemistry, dating back to the beginnings of the company in 1897, has contributed two products of significance in fire extinguishing and fire prevention. Dibromodifluoromethane, a material unique in its low toxicity, is used to combat in-flight fires. Bromochloromethane is mixed with detergent and sprayed on runways in a thick foam to reduce friction and prevent fires.

Dow additives prevent icing in jet aircraft fuels. And Dow De-icing Fluid 146, an ethylene glycol-based product for deicing and defrosting parked aircraft, now has been incorporated (with ordinary sand) in a new system for improving traction on icy airport runways.

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Of all the Dow products, magnesium metal probably is the one most closely associated with the aircraft and aerospace industries. The company has been involved with magnesium for 53 years. For decades the metal was extracted from brines underlying the state of Michigan. In 1941, Dow started mining magnesium from the sea at Freeport, Texas. Besides its production of primary metal, Dow manufactures aluminum and magnesium mill products.

Primarily because of its light weight, more magnesium has been put in orbit than any other one metal. Magnesium was used in the Gemini, Titan, Polaris, Vanguard, Jupiter and Scout rockets. The same is true for the Agena, Echo, Courier, Early Bird and a number of other satellites.

Dow supplies aluminum spar extrusions used for the wing structure of the Boeing 747. Some of these extrusions are 105 feet long, the longest ever produced for aircraft. Dow-produced aluminum extrusions also have been used in the 707 and the 727. And the company has furnished more than 1,100 miles of aluminum landing mat for the Air Force.

Precision Fabrication Services, an activity related to the company's metals business, was formed by Dow to keep pace with the ever-increasing requirements of various industries for highly precise metal parts. This operation, located in Denver, can procure basic raw materials, write specifications for its procurement, and supply finished machined parts including tooling,

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gauging, manufacturing planning, and complete numerical control programming packages. Precision Fabrication Services has supplied machined parts for commercial and military aircraft including the Boeing 737 and the giant C5A cargo plane.

Dow also is heavily involved in the service aspects of the Apollo flights. Two years ago Dow Aerospace Services pooled its resources with those of Catalytic Construction Company, thus becoming Catalytic-Dow, and entered into a joint venture which bid successfully on a four-year contract to provide engineering, construction and modification services related to launch systems and facilities at the space center. Most of the effort of Catalytic-Dow has been directed to the support of the historic Apollo flights.

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