LIA's GoLIAth: A pioneer electric vehicle

On August 14, 1978, Lead Industries Association's (LIA) battery-powered delivery van was placed in permanent demonstration service with the National Capital Region (NCR), the division of the National Park Service that maintains Federal parks and historical sites in the Washington, D.C. area.

In a ceremony on the Mall near Washington's famed Reflecting Pool, William P. Wilke III, Chairman of LIA, presented the keys to GoLIAth to Ira Hutchinson, Deputy Director of the National Park Service. As part of the ceremony Mr. Wilke discussed GoLIAth's history and the vehicle's contribution in furthering the development of electric trucks. The following are highlights of his remarks:

GoLIAth is the forerunner of thousands of battery-powered electric work vehicles that are expected to be in service in the immediate future. A 6,000-lb gross vehicle weight enclosed van, GoLIAth was purchased by LIA to demonstrate the advantages of battery-powered, short-haul delivery vehicles to perform a wide variety of pickup and delivery, as well as personal transportation tasks.

GoLIAth is the first U.S. production-line electric since the late 1920's. It is one of the more than 100 such vehicles ordered by the nation's electric utilities to test and evaluate the performance of lightweight battery-powered trucks in a variety of in-service performance tasks, and to determine what effect the large-scale use of such electrics could have on electric power consumption.

The program was administered by the Electric Vehicle Council and, as an associate member of that organization, LIA played an active role in the electric vehicle research and development program. Significantly, this program was launched in 1972, about five years before Public Law 94-413—the Electric & Hybrid Vehicle Research, Development & Demonstration Act of 1976—was passed.

LIA's program was devoted to the primary objective of the electric vehicle development project—to determine the type of in-service work situations electrics can best perform. An additional important part of the LIA program was to inform as many potential users of battery-powered trucks as possible about the advantage of electrics.

During 1974, GoLIAth completed a 25-city tour of the U.S. and Canada while performing a wide variety of demanding tasks. Placed in operation again in 1975 for extended periods of time, GoLIAth further demonstrated its ability to operate in a variety of temperatures and terrain.

It is indeed fitting that GoLIAth be turned over to the United States Department of Interior for operation by NCR. For years, NCR and LIA have shared a common goal: to introduce the use of battery-powered electric work vehicles.

NCR's electric vehicle development program is perhaps the most successful of any such program in the country. Its 50-vehicle fleet includes more than a dozen different types of electrics—all the way from an 18-passenger bus to cargo carriers, dump trucks, passenger cars, and even a street and sidewalk vacuum cleaner. They provide outstanding examples of how scores of work tasks can be performed by quiet, efficient, non-polluting electric vehicles.

It was primarily due to the success of this electric vehicle development program that GoLIAth was first assigned to NCR for a demonstration and evaluation program in June, 1976. The LIA vehicle was a familiar sight in the Mall area that Summer, transporting personnel and maintenance equipment to and from the festival of American Folklife. Based on the initial success of this demonstration program, GoLIAth was again assigned to NCR for an extended test and demonstration program in April, 1977.

In the interim, the vehicle, re-named GoLIAth II, underwent extensive redesign and reconstruction. This included a more streamlined body, the latest in tires for electric trucks and an advanced electronic motor controller. Also a new type of fuel gauge gives both the driver and maintenance personnel a better understanding of how much energy is available in the batteries. But most important of all, GoLIAth II was equipped with the newest maintenance-free lead battery for starting/lighting/ignition to operate the truck's lights, windshield wipers, heater fan, and other electrical components other than the motor.

GoLIAth might be considered the vanguard of the commercial electric vehicle industry. It represents the first of many electric trucks that will appear on the streets of the U.S. in the near future. Meanwhile you can rest assured that the lead industry will continue to develop improved lead acid batteries to extend the range of not only these trucks, but also passenger cars and buses.

William P. Wilke III, Chairman of Lead Industries Association, Inc. (left), turns over keys of GoLIAth to Ira Hutchinson, Deputy Director, National Park Service.

CONNEL A. BAKER, JR.

It is with regret that we announce to Connel Baker's many friends and acquaintances in the industry his death on June 21, 1978. Connel joined the LIA in 1963 and immediately found his niche in the battery area. He gathered background material and helped to write publicity articles and advertisements on industrial battery applications. Later he was instrumental in LIA's obtaining the FIRST electric van of the GoLIAth type, and he traveled 25,000 miles around the U.S. and Canada promoting acceptance of a concept whose time has now arrived! Meanwhile, we watched the industrial battery market for lead grow from 30,000 to 90,000 tons annually. Surely Connel's tireless and persistent work in this field contributed much to growth in this market. His many friends on staff will miss Connel Baker sorely.

pneumatic-tire electric lift trucks gain favor for indoor/ outdoor applications

John Deere's pneumatic-tire electric fork lift efficiently transports bulky subassemblies from one building to another.

Improved lead-acid batteries and solid state controls, coupled with the increasing cost of fossil fuels, have boosted the popularity of electric fork lift trucks. Now industry is taking a closer look at battery-powered lift trucks equipped with pneumatic tires for outdoor as well as indoor material handling applications. The versatility of these trucks permits users to standardize on electricity as a single fuel source and to avoid having maintenance facilities and parts for both combustion engine-powered and battery-powered types.

Most pneumatic-tire electrics being marketed here are adaptations of trucks being used in Europe, where electricity has been a primary energy source. The pneumatic tires also are favored because they supply greater traction to negotiate cobblestone and macadam surfaces commonly found around factories and storage yards. Also, the advanced age of many European factories limits the allowable floor loads. The wide footprint of the pneumatic tire spreads the load better than cushion types.

Now industrial plants in this country are becoming increasingly aware of the suitability of pneumatic-tire electric lift trucks to their particular operation. For example, chemical and paint plants often have outdoor product storage areas which could be served by this type of truck. And these plants often require lift truck operation in hazardous environment where electrics are eminently more suited to function.

Environmental considerations often dictate the use of fume-free electrics in cold storage warehouses and food processing plants. Yet slippery floors can preclude the use of cushion-tire types. However, the pneumatic tire's wide tread contact area can provide the necessary traction on wet or greasy floors.

Pneumatic tires filled with urethane polymer also offer added blowout protection against the debris often found on the floors of foundries. And the ability to move in and out of tight spots in a storage yard filled with cores and molds gives these trucks another advantage in foundries and steel mills. In lumber yards, the pneumatic-tire electric vehicle can reach piles of wood stored off the concrete apron on a gravel surface. This task is a marginal application for a cushion-tire truck.

The marketing manager of a leading lift truck manufacturing firm sees a growing interest in pneumatic-tire electrics for these applications, as well as other indoor/outdoor uses. "They combine some of the best characteristics of both electrics and engine-powered trucks with pneumatic tires," he said. Users are also finding an extra plus in the fact that the pneumatic tire casing can be recapped a number of times, usually for less than the cost of a solid new tire.

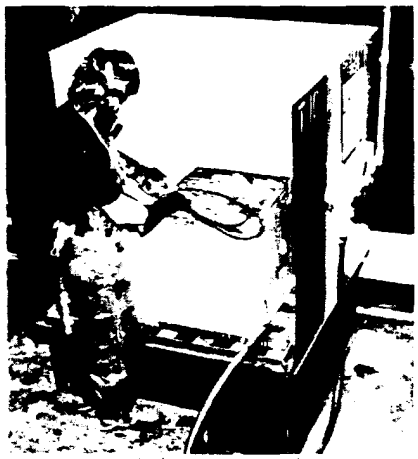
An unusual feature of some pneumatic-tire electrics is the 72/80 volt electrical system that draws its power from two standard 36-volt lead acid batteries connected in series. This higher voltage is the European standard. The control system enables the higher voltage to deliver the same power output at greatly reduced amperage. Top speeds can equal those of engine-powered trucks. However, the electric has the advantage of greater low speed capabilities.

A pneumatic-tire electric fork lift is currently performing satisfactorily at the John Deere Waterloo Tractor Works in Waterloo, Iowa. The 7000-lb capacity, 72-volt Clark Equipment truck travels back and forth between two buildings, 1500-ft. apart, carrying heavy loads. The two 600-ampere-hour 36-volt lead-acid batteries provide ample power for six hours of continual shuttle service. Two sets of batteries are used since the service is required for two shifts.

The fact that the truck is electric means that it can go indoors too, without creating air pollution problems. In one building it picks up racks with transmission-axle sub-assemblies, delivers them to a tractor assembly area in the other building and returns with the empty racks.

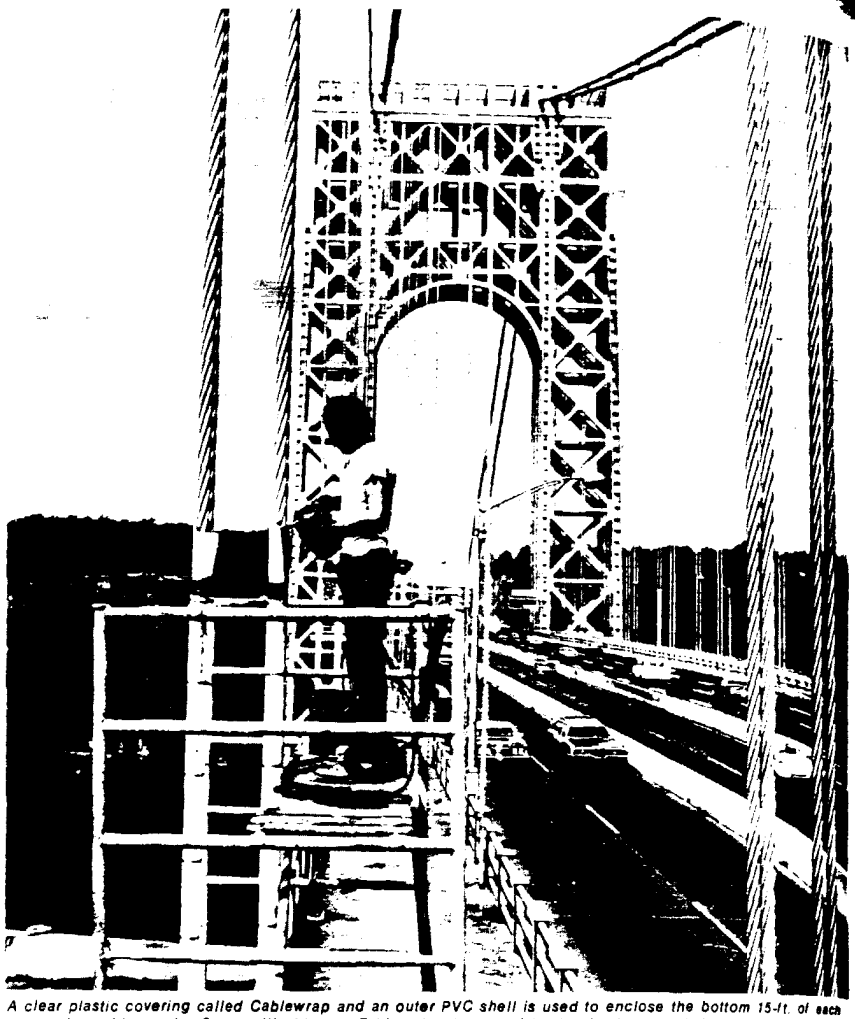
In its travels between the two buildings, the truck must cope with Iowa weather: rain, sleet, snow, heat and cold and resulting bad road conditions. The heavy loads must be transported over a 1% to 2% grade between the buildings and three railroad crossings. Also, there are doorways to pass through, while carrying a 10-foot long load.

John Deere considers this shuttle service as a "test case" for high voltage electric pneumatic-tire trucks, which can lead to further applications. The company launched an electric truck program in 1973 to provide economical, dependable production service with minimized downtime and reduced maintenance. Since then, a further incentive has been to cut dependence on LP-gas, to conserve energy and to reduce noise and ventilation problems. Wherever possible, even in yard operations, battery-powered trucks will be used.



Batteries are washed down frequently in this simple stand. The job is done quickly and easily with water alone.

"Poured in place" red lead protects George Washington Bridge



A clear plastic covering called Cablewrap and an outer PVC shell is used to enclose the bottom 15-ft. of each suspender cable on the George Washington Bridge. In photo, red lead paint is poured down into the enclosed area where the paint soaks into the cable and provides a secure barrier against the effects of corrosion.

Red lead paint poured into can travels through tube which extends down through cutouts in bridge deck and flows into portable "dam" which surrounds bottom 3½ ft. of the bridge cable.

A unique method of applying red lead paint to the steel suspension cables that support the George Washington Bridge has eliminated a potentially serious corrosion problem that faced the Port Authority (PA) of New York and New Jersey, operator of the famed structure. The graceful bridge, which connects the island of Manhattan with New Jersey, has become one of New York City's best-known landmarks since it was built in 1931.

The 1,184 suspender cables that support the bridge are subjected to the corrosive attack of rain, fog and snow throughout the year. Protecting these cables from corrosion is a problem and particular care must be taken to provide special corrosion protection for lower sections of the cables that are near or adjacent to the bridge deck. They are continually splashed with salt-laden slush, rain, snow and other debris from passing vehicles during the winter.

Robert P. Crandall, PA Supervising Engineer—Construction Division—Engineering Department, explains that as a result of this continual splashing, the lower 12-ft. of each cable above the sidewalk, and especially the bottom 3½-ft. which extend below the sidewalk of the Bridge's upper deck are prime targets for serious corrosion problems. The slush and other moisture splashed on the cable seeps through the strands and down the sides of the cable to settle in the bottom 3½-ft. where the cable attaches to the Bridge deck. If allowed to build up, the residue could corrode the cables in this area.

After a careful study of the problem a two-fold solution evolved. The first step was to encapsulate the bottom 15-ft. of each cable with a 5-mil clear plastic covering called Cablewrap, which is then heat sealed. A Schedule 40 split PVC pipe is then placed around the Cablewrap and the entire installation is secured with hose clamps. The PA pointed out that while the height of the "splash zone" was actually 12-ft., it was decided to encapsulate up to a height of 15-ft.

as an extra precaution. Using a funnel, members of the paint crew then pour red lead paint down into the encapsulated area where the paint soaks into the cable, filling any voids and providing a very tight, secure barrier against the effects of corrosion.

Old paint, of course, is removed from the cables prior to the two-step encapsulation and red lead treatment. Removal of the old paint is accomplished by first applying a solvent and then water-blasting the cables down to the base metal with a high pressure water jet.

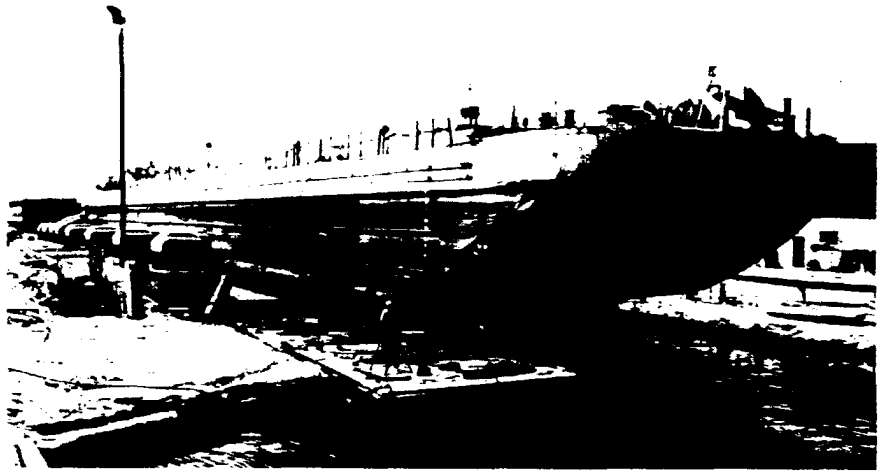
The second part of the plan is centered upon the bottom 31½-ft. of each cable, located below the sidewalks that run alongside the upper level of the two-level bridge. Although this portion of the cable is also encapsulated, the fact that all the slush, rain and other debris settle in this lower area prompted the PA to add an extra measure of protection against corrosion. This added protection involved soaking the lower portion of the cables in a "bath" of red lead paint, using portable rubber "dams" that were placed around the bottom 31½-ft. of each cable.

Red lead paint is fed into these dams from a paint can set on the sidewalk above. A tube attached to a spigot on the paint can extends down through the circular cutouts in the sidewalk through which the suspender cables pass. Paint flows down through the tube and settles in the dam, soaking around and up into the bottom portions of the cables. The PA reports that the portable dams hold about 3½ to 4 gallons of paint and that the entire cable treatment will require using approximately 7200 gallons of red lead. If the accumulated impurities in the red lead are minimal, the red lead may be used over again.

The PA has been using red lead as the prime coat on its bridges for a number of years and feels that it is one of the better means of protecting steel structures from the effects of atmospheric and other forms of corrosion. Additionally, Robert Crandall says that red lead is more flexible in that it does not crack or chip when the cables flex due to the movement of the bridge.

Completing the red lead treatment is expected to take approximately four to six months, after which a top coat paint will be applied. The PA expects to use the same method on the 216 cables of its Bayonne Bridge which connects Bayonne, N.J. with Port Richmond, Staten Island, N.Y.

Red lead primer stretches barge life



Barge in dry dock ready for maintenance painting.

A surprisingly large number of barges ply American inland waterways and off-shore areas today. It is estimated that there are over 20,000 barges in service in U.S. waters and red lead primer helps to keep many of them on the job.

The major portion of the nation's barge fleets consist of hopper and tank types. Not long ago most barges were considered expendable. When one became heavily dented and corroded, it was scrapped. However, like the cost of almost everything, barge building has become increasingly expensive. This is causing many barge owners and operators to take a harder look at maintenance painting to stretch barge life.

"It used to cost almost as much to paint a barge as to build one," one barge owner said. "However, painting costs have not increased to the extent that barge building costs have. So the economics of better maintenance practices cannot be ignored." In addition, with more easily controllable towboats in the water today, barges do not suffer the damage they did in the past. This increases the practicality of applying a good protective coating, since it is likely to last longer.

One barge rental company based in New Orleans is not only aware of the economic advantage of protecting the steel from rust, but also believes that appearance counts. All of the deck barges belonging to Thomas Jordan, Inc., are painted with a red lead primer above the waterline and then coated with an epoxy in a distinctive shade of yellow. The color sets Thomas Jordan barges apart from those of the competition.

John O. Brown, who heads sandblasting and painting operations for the company, notes that the surface preparation is the costly part of barge maintenance. "Your crews will sandblast for six or seven hours and paint for an hour. This makes surface preparation far more costly than painting from a labor standpoint alone," he said.

Because of this, Brown feels it makes sense to use the best protective coatings available to protect a barge. Finding it difficult to obtain a red lead primer with the necessary high density, the company contracted with a local manufacturer to have a red lead primer formulated to its own specs. The special mixture weighs 18 pounds per gallon as a result of the extra lead, and naturally costs more.

Brown believes the extra expense is worthwhile. "It prolongs the life of the coating and the barge," he said. "Our experience indicates that this red lead is a superior primer and we are willing to pay a premium price to get it. In the long run we find it's the cheapest way to go."

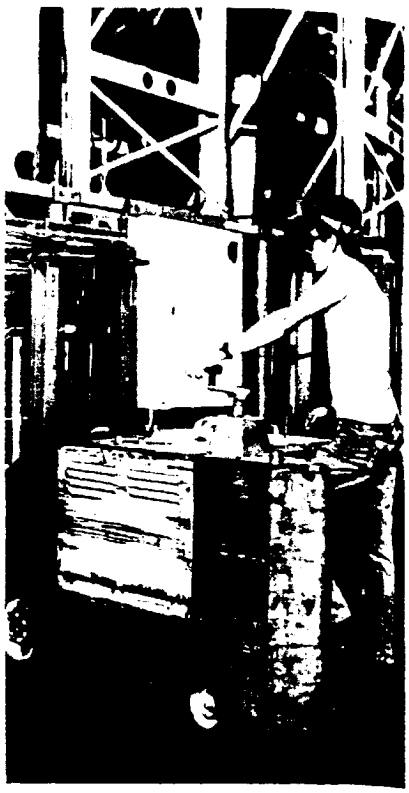
Another New Orleans barge rental firm reports that many customers request that their barges be put on floating dry dock and painted after several years. In salt water a barge may last only two or three years without a protective coating. In fresh water a barge may last up to five years without a recoating.

A spokesman for the rental company said that they had some forty-year plus off-shore barges still in operation, thanks to the company's policy of maintenance painting. Since the cost of a new barge averages between $175,000 and $185,000, the money spent on maintenance labor and supplies seems like a sound investment.

Electrics play key role in mushroom farm operation

Specially-designed lead-acid battery-powered personnel carriers transport workers to mushroom picking site.

Personnel carrier has its lead-acid batteries recharged between shifts.



Battery-powered stand-up fork lift moves ready-for-market mushrooms from packaging area to shipping department.

How do you handle the chore of harvesting 50 million pounds of mushrooms annually when you grow them underground? Clean, quiet lead-acid battery-powered work vehicles can be a big help. At least that's what Butler County Mushroom Farm, one of the world's largest producers, discovered some time ago.

Mushroom farming is big business. For many Americans these tasty tidbits represent the ideal complement to steak and other dishes. Butler grows its mushrooms in a worked-out limestone mine at Worthington, Pa. High humidity and year-around temperature of 56°F combine to provide a natural environment for this activity.

Currently, the Butler farm harvests twice as many mushrooms as it did ten years ago, and its fleet of 110 lead-acid battery-powered vehicles is almost double the number used at that time. The increased productivity can be attributed in no small measure to the fast, low-cost, reliable operation of these vehicles throughout the years.

The fleet of electrics presently operating on the premises consists of 50 large personnel carriers, 35 fork lifts, both rider and stand-up types, and 25 two-man personnel carriers. These vehicles are involved in the mushroom growing process from the collection of spores for spawning to the final dumping of the compost trays.

Above ground facilities at Butler consist of a spawn laboratory, process and research departments and a packaging area. The remainder of the operation is conducted underground. The mushroom cycle starts with spores developed under sterile conditions to provide a spawn. Then large wooden trays filled with compost are placed in pasteurizing rooms at 135°F for three days. The spawn is then planted in the compost, and trailers move the trays, which weigh 1,600 lbs. each, to spawn growing rooms in the upper part of the mine. A special circulating system and air from the mine maintain the temperature at 70°F to promote initial growth.

After three weeks the trays are moved by electric fork lifts to the machine room where the growth is covered with a layer of rich, loamy soil. The trays are next transported to the lower mine for the rest of the growing period.

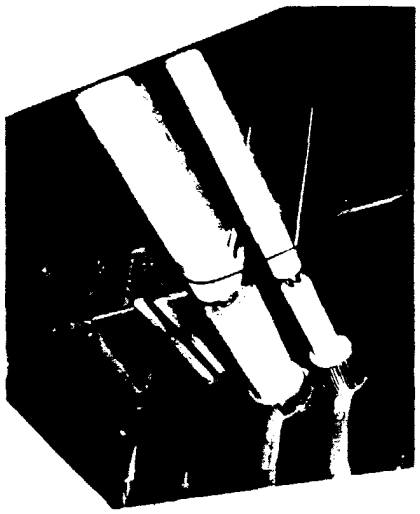
After 21 days the picking begins. Workers are transported underground in specially-designed lead-acid battery-powered personnel carriers, each with a capacity of from 15 to 18 passengers. Picked mushrooms are racked on flatbed trailers which are attached to the rear of these vehicles to carry the crop to the surface. The vehicles also carry crews to and from an underground cafeteria. And battery-powered carriers are used by the food concessionaire to service the cafeteria.

During the picking time trays are picked daily, to assure that the mushrooms are at the proper stage of maturity. To provide working light, the pickers wear hard hats, topped with lead-acid battery-powered miner's lights.

When a tray is completely picked, it is transported to the surface where electric fork lift trucks take it through a sterilization process and dumping. Trays are then carried back to be refilled, and the growing process starts over again.

Sheet lead governs noise in new addition to Oregon state capitol

Oregon State Capitol, Salem, Oregon.



Lead sheet plenum barriers can be seen above hung ceiling in one of the offices.

Increasingly, noise is becoming a serious problem in today's modern office buildings. Noise from typewriters, conversations, mechanical equipment such as fans and air conditioners, and noise from the streets all act as a deterrent to concentration.

Most offices have a hung or drop-ceiling made of lightweight materials. Partitions between these offices usually stop at the level of the hung ceiling, leaving an open space above the ceiling. This opening, called the plenum, provides free access for noise to pass from one office to another over the partition. A hung ceiling only reduces reverberation of sound within an office. It does not act as a barrier to prevent its escape. Perforations in ceiling tiles, and openings required for lighting fixtures and sprinkler heads allow sound to enter the plenum, pass over the partition and enter adjacent offices.

Very often sheet lead plenum barriers are specified as a solution for noise problems. Lead barriers are one of the most efficient and economical ways to block sound transmission between offices. For example, sheet lead plenum barriers were used to soundproof 12 to 15 offices on each of seven floors in two new four-story buildings that were added to the Oregon State Capitol in Salem, Oregon.

The project's architect specified 1/64-in.-thick lead sheet which weighs 1 lb. per square foot (psf). About 10 tons of lead were required for the project. While gypsum board and other absorbing materials were considered, lead sheet was finally selected since it represents the best sound barrier at reasonable cost.

The sheet lead was installed by Ceiling Systems, Inc., Portland, Ore. According to Clare Woodward, Vice-President and General Manager of Ceiling Systems, "We found that sheet lead could be easily worked around pipes and ducts and showed good bondability and effective sealing."

A spokesman for the architect stated that "the best way to soundproof an open-plenum office is to extend sealed wall partitions all the way up through the ceiling." Installation followed this method.

Plenum depth was five feet in the first two stories of the two buildings, and four feet in the third and fourth stories. The sheet lead was cut to lengths equal to the plenum depth plus an extra six inches to allow for a lap onto the upper ceiling surface; four-foot wide sections were than hung vertically. Hanging was accomplished by notching both top corners 3-in. x 1½-in., folding over the 1½-in. tab for vertical seams, and wrapping the top edge of the sheet around the outside of a black iron channel. The channel and lead were fastened to the underside of the deck on 24-in. centers. Seams between vertical sheet were formed by rolling, or by turning up the 1½-in. tab at each vertical edge and sealing with 2-in. duct tape.

Relatively simple techniques were sufficient to fit and seal the lead sheet around pipes, wires, and ducts, and under "pan"-type floors. For pipes and ducts the sheet was slit from the bottom to the point of penetration, where "orange peel" slits were made to accommodate their diameter. The sheet was then draped over the obstruction, and the orange peel segments were collared tightly and taped securely against it. Finally, the remaining vertical slit edges were drawn together and taped.

Source: Federated Metal Corp.

LILCO lights the way with electric vehicles

LILCO's "Battronic Van" has a sensitive job. The work vehicle has been used as a gas sniffer to detect main leaks. Van has 182 cu ft. of cargo space and a cruising speed of 30 mph.

LILCO uses seven "Electra Vans" on meter reading routes from locations in Roslyn, Hewlett and Brentwood, Long Island. Vans have a maximum speed of 55 mph and a range of 60-100 miles.

Four "CitiCars" perform on-site security patrol at various LILCO plant locations on Long Island. The cars hold two passengers and have a cruising speed of 35-38 mph.

If Long Island one day leads the nation in the use of electric vehicles, it may be due. in part. to the initiative of the Long Island Lighting Company (LILCO). The utility company, which supplies electricity and gas to the millions of homeowners and thousands of large and small industries on the island, is involved in an electric vehicle demonstration program that will likely have a dramatic impact on the acceptance of electric vehicles.

LILCO's EV demonstration program currently involves 12 lead battery-powered cars and vans. They are performing regular service functions. At the same time, they are giving the utility's customers and the general public a close-up look at electric vehicles in actual operation.

Based in part on the success of the LILCO electric vehicle program, the utility has been selected by the Department of Energy (DOE) to be a demonstration site operator under the Electric and Hybrid Vehicle Program. Passed by Congress in 1976, the program calls for about 7,000 electric and hybrid vehicles to be placed in commercial service to demonstrate the effectiveness of such vehicles to perform the same tasks as internal combustion types.

LILCO's EV fleet includes seven lightweight vans. Each is powered by 16 six-volt lead-acid batteries. They replace conventional cars used for meter reading service.

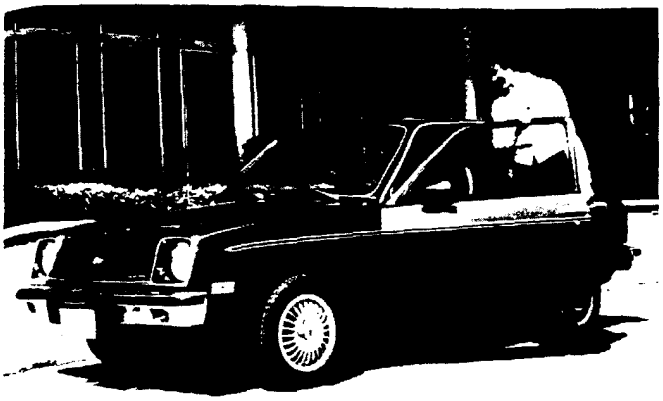
Four two-passenger cars, powered by eight lead-acid batteries, are performing on-site security patrol. A heavy-duty commercial van, also classified as lightweight since it weighs less than 10,000 lbs., transports personnel and equipment for a team of experts in detecting gas pipeline leaks.

DOE has announced the selection of five private companies as demonstration site operators for electric vehicles. In addition to LILCO, those selected are American Telephone & Telegraph Co., Los Angeles; Consolidated Edison Co., New York City; Walt Disney World, Lake Buena Vista, Fla.; and Penn Jersey Subaru, Inc., Pennsauken, N.J. The latter firm will sell or lease the vehicles to individuals and small companies. The five firms are expected to order 165 electric and hybrid autos, vans and light trucks this year. An additional 35 electric and hybrid vehicles will be purchased by other Federal agencies during the current fiscal year for testing on a cost-sharing arrangement with DOE.

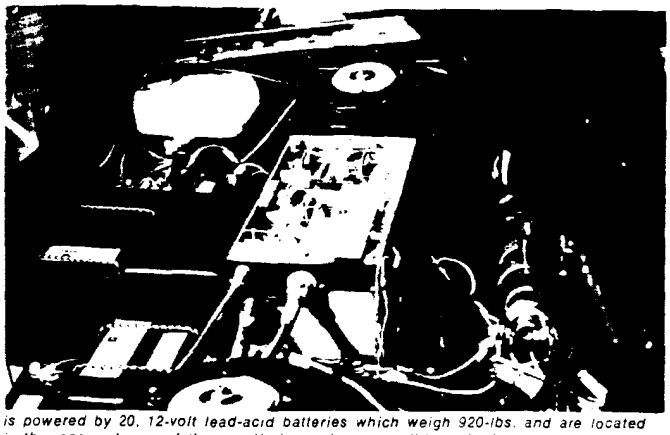
The vehicles are recharged at night when there is less demand for electricity. Careful record-keeping so far shows the electrics to be cost effective in comparison to conventional equipment. LILCO is actively pursuing opportunities to participate in government and industry sponsored research and demonstration programs as a way of contributing toward the overall development of electric vehicles. All program data and analysis results are available to government agencies as well as potential users.

Public interest in the vehicles is at a very high level and has added a new dimension to the drivers' job. When the cars are in use, numerous questions are asked by pedestrians and other drivers. Most are concerned with the vehicles' capabilities. Hundreds of specially prepared brochures have been distributed in response. The electrics have also been displayed at various trade shows and exhibitions where consumers, as well as industry, government and education representatives have expressed an interest in purchasing such vehicles.

General Motors unveils battery-powered car



General Motors Corporation has introduced the first in a series of battery-powered experimental autos. Called the Electrovette, the car is a modified Chevrolet Chevette. GM reports that the car has a top speed of approximately 55 mph, a range of 40 to 50 miles at 30 mph, and can accelerate from zero to 30 mph in 9.2 seconds. The car



is powered by 20, 12-volt lead-acid batteries which weigh 920-lbs. and are located in the rear-seat area of the car. Under optimum conditions the batteries can propel the car on a single charge about the same distance as one gallon of gasoline—approximately 41 miles.

Battery-powered robots run the mail route

Call them "Robby", "Egore" or "Norman the Mailer", lead power is running a new breed of lead battery-powered robot carts in some surprising new uses. . . .

Known as "Mailmobiles", the robot carts are delivering the mail in a growing number of offices across the country. Sears Tower in Chicago, the dramatic new Citicorp Center in New York and the U.S. Department of Commerce in Washington are examples of some major users. Powered by four, six-volt lead acid batteries, the Mailmobiles are capable of running a minimum of eight hours on one charge and are equipped with a self-contained battery charger. Recharging is performed overnight by simply plugging the retractable charger cord into an electric outlet.

The 550 lb.. self-propelled vehicles are guided from one stop to another by a colorless chemical line sprayed on the floor. This invisible path is compatible with all floor surfaces and, unlike buried wire guidance systems, can be easily removed and re-routed. The carts go around corners and can turn completely around if necessary.

Standing four feet three inches high, two feet wide and five feet long, the Mailmobile's clean, functional lines blend well with most office decor. Mail can be sorted directly into delivery compartments, eliminating the need for double-sorting. Packages and office supplies can be carried on top. The loaded vehicle is easily maneuvered to its starting point by means of a steering handle with an integral hand-operated grip switch. This switch controls both forward and reverse movement. The handle retracts into the vehicle for automatic operation.

The loaded carts are started on their rounds by simply flicking a switch. After that they automatically stop for 10 to 20 seconds at designated "mail stop" stations. To detain them beyond the automatic interval one need only depress a red "stop" switch which runs full-length along the top of the cart. Travel resumes when a green "start" switch is activated.

Mailmobile has numerous compartments for mail sorting and delivery. Space on top is used for bulky items.

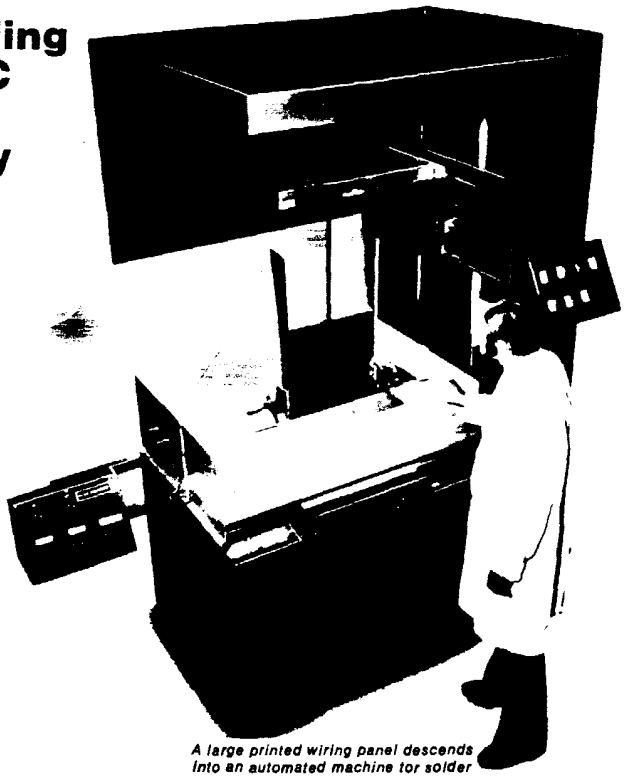
The Mailmobiles make their rounds on an hourly schedule or more frequently, if required. Reportedly, it costs essentially the same to run the cart eight times a day as it would for a four-a-day schedule. In general, Mailmobiles boost the number of daily pick-ups and deliveries wherever they are used.

Soft, pressure-sensitive bumpers automatically stop the Mailmobile when obstacles are encountered. When the obstacle is removed, motion resumes automatically. The unit moves at a speed of about one mile per hour; slower than the average person walks. An audible soft tone and a pair of flashing blue lights announce its arrival and add to safe operation.

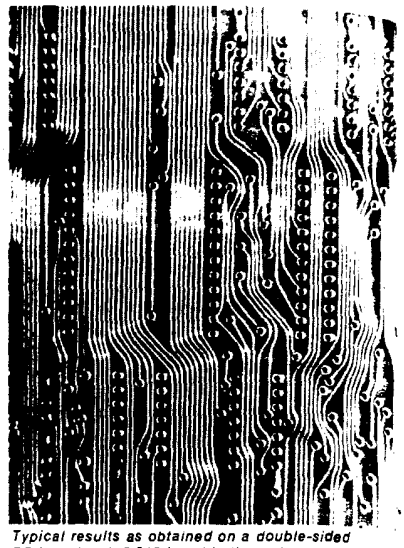
Lear Siegler, Inc. of Zeeland, Michigan, manufacturer of the Mailmobiles, say the carts have become increasingly popular mostly in banks and insurance companies. Some 250 are in use throughout the country, including nearly 60 in New York City alone.

Each Mailmobile costs between $12,500 and $13,500. However, one satisfied customer who has purchased three reports that mail delivery was stepped up from four times a day to every half hour, and $150,000 was saved in the first year of operation. That's really "First Class" delivery!

Hot air leveling improves PC board solderability



A large printed wiring panel descends into an automated machine tor solder coating and hot air leveling.



Typical results as obtained on a double-sided PC board with 0.015-in. wide lines after solder coating and hot air leveling.

A quality control problem in printed circuit (PC) board production is maintaining the solderability of such boards while they are being stored prior to assembly. Simply stated, unless properly protected, circuit surfaces deteriorate due to a form of corrosion called oxidation. Such surfaces cannot be effectively solder joined.

One means of preserving solderability is through the use of an organic protective coating or surface treatment. A more commonly used method is to electroplate a 200 to 300 micro-inch coating of 60/40 tin lead solder on the circuit surfaces. Often a pressurized liquid is then sprayed on the board to level the solder, remove any excess and clear the plated-through holes.

Now a system called hot air leveling combines solder coating and leveling functions into one operational cycle to achieve the desired PC board protection. Originally developed by Sandia Laboratories, Albuquerque, N.M., the process reportedly offers these advantages:

- The hot air method applies solder coatings of high quality and uniformity.
- The short cycle time involved reduces electrical energy usage up to 50 percent of that required by other leveling methods.
- Overall process time is reduced by up to 70 percent.
- There is no fire hazard.
- The hot air leveler has few installation requirements.
- Thermal degradation to the PC boards is reduced since the solder coating and leveling takes place almost simultaneously.

The hot air process can be used on single-sided, double-side and multilayer PC boards. The fixtured board is fluxed and then lowered into a pot of molten solder. After a given dwell time, depending on the type of board involved, electrically heated compressed air knives are actuated and the board is withdrawn between them. Hot air flowing from the knives at about 50 psi sweeps off excess solder, levels the board, clears the holes and leaves a bright layer of solder to a specified thickness. The excess solder drops back into the pot.

Any solder alloy composition can be used in the pot, although 63/37 to 60/40 tin lead ratios are the most common. The coating deposited on the board is uniform in composition over the entire surface and possesses the same composition as the alloy in the pot.

By combining the solder coating and leveling functions the hot air system eliminates the need for prior tin lead electroplating. Circuitry on the boards may be bare copper, with or without solder resist, tin or tin lead plating. The results reportedly meet all appropriate military specs.

Some of the firms known to manufacture hot air leveling systems are Electrovert, Mount Vernon, N.Y., Hollis Engineering, Nashua, N.H., and Gyrex, Inc., Santa Barbara, CA.

2ND U.S. SOLDER FORUM SCHEDULED

The high degree of interest generated by the 1st U.S. Solder Forum held in Chicago last year has prompted the scheduling of a second Forum on November 13 and 14, 1978 at the Twin Bridges Marriott Hotel in Washington, D.C. Designed to communicate facts and fundamentals about soldering, the program will feature addresses by recognized experts in solder application and technology. The forum is sponsored by the Solder Manufacturers Committee of the Lead Industries Association, Inc. and is being supported by The Tin Research Institute, Inc.

Record use of lead at World Trade Center

New York City's spectacular World Trade Center is such an impressive building achievement that many records were set during the course of its construction. Not the least of these is that approximately 700,000 lbs. of lead waterproofing was installed in areas around the huge center.

This enormous use of lead includes what is believed to be two record-setting applications:

- The most lead used to line landscaping planters . . . about 500,000 lbs.
- The most lead used to flash the base of buildings . . . about 72,000 lbs.

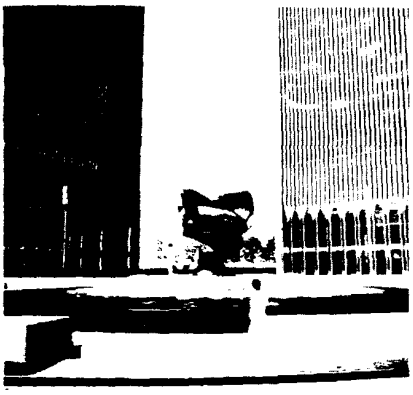
All of the lead was used primarily for moisture protection, most of it being installed in the World Trade Center Plaza, a huge five-acre elevated platform that surrounds the Center's building complex. Lead's corrosion resistance, freedom from maintenance and the fact that it provides for a trouble-free waterproofing membrane are the primary reasons why it was selected. There have been no reports of water leakage since completion of the Center in 1974.

Lead was used on the Plaza level of the Center to line 26 huge landscaping planters and as flashing around the base of buildings facing the Plaza's center court. In addition, about 77,000 lbs. of lead waterproofs the center court's huge water fountain.

Lead also was used to line 30 planters on the street level and to waterproof exterior stairways leading from the street level to the Plaza and from the Plaza to the Center's Concourse level. About 51,000 lbs. of lead was used for the latter application.

Lead's watertight integrity is important to the Center. Since the Plaza area serves as a roof for the Concourse level with its restaurants, shops and other facilities, water leakage would be disastrous. Part of the Concourse, as well as subway facilities are also located beneath the street so waterproofing was required at this level too.

The lead was installed by John F. Abernethy & Co., Brooklyn, N.Y., and Allied Lead, Inc., Chicago. Both 6 psf (3/32-in. thick) and 8 psf (1/8-in. thick) lead was used. The Center was designed by Minoru Yamasaki and Associates of Troy, Mich., and Emery Roth and Sons of New York City, and built by the Port Authority of New York and New Jersey.



Lead waterproofs huge water fountain that dominates center court at plaza level.

Street-level planters are lead-lined to prevent water leakage to Concourse and subway facilities below.

Lead lines the many planting areas at plaza-level, to keep Concourse below dry and secure.

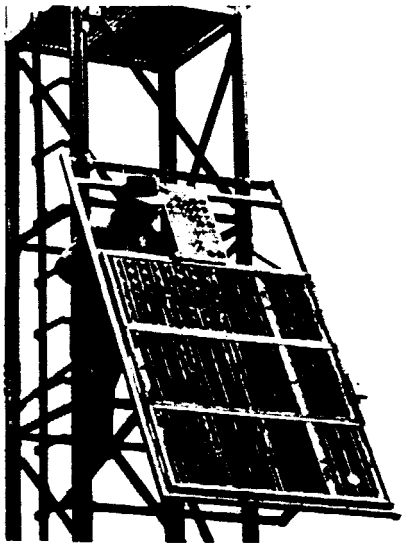
World Trade Center's Twin Towers, each 110 stories high, have changed the look of New York City's famous skyline.

Batteries store photovoltaic power for remote weather stations

Weather forecasters across the nation have a new ally in their struggle to accurately predict the weather. That ally is five new automatic weather reporting stations operated by battery-stored, solar-cell generated power. Located in remote and sometimes inaccessible areas, they make possible the earlier and more accurate prediction of sudden tropical storms, winter snows, freezing rain and other severe weather conditions. The benefits of these early warnings to farmers, ranchers, travelers, boaters, and motorists, among others, are impossible to calculate.

The five new solar battery-powered stations are the first in a series of 38 automatic weather stations developed by the National Weather Service. They are used in a network of about 1000 manned and unmanned reporting stations, located coast-to-coast, including Alaska and Hawaii. Designated RAMOS (Remote Automatic Meteorological Observing System), each station reports temperature, dewpoint, wind speed and direction, barometric pressure, and precipitation readings hourly to forecast offices via radio, satellite or telephone. The solar power systems were designed and installed by NASA's Lewis Research Center in cooperation with the National Weather Service and the Department of Energy (DOE).

Unlike other more conventional electrical power generation systems, solar cell powered units require no fuel or periodic maintenance, and are designed to operate uninterrupted for years.

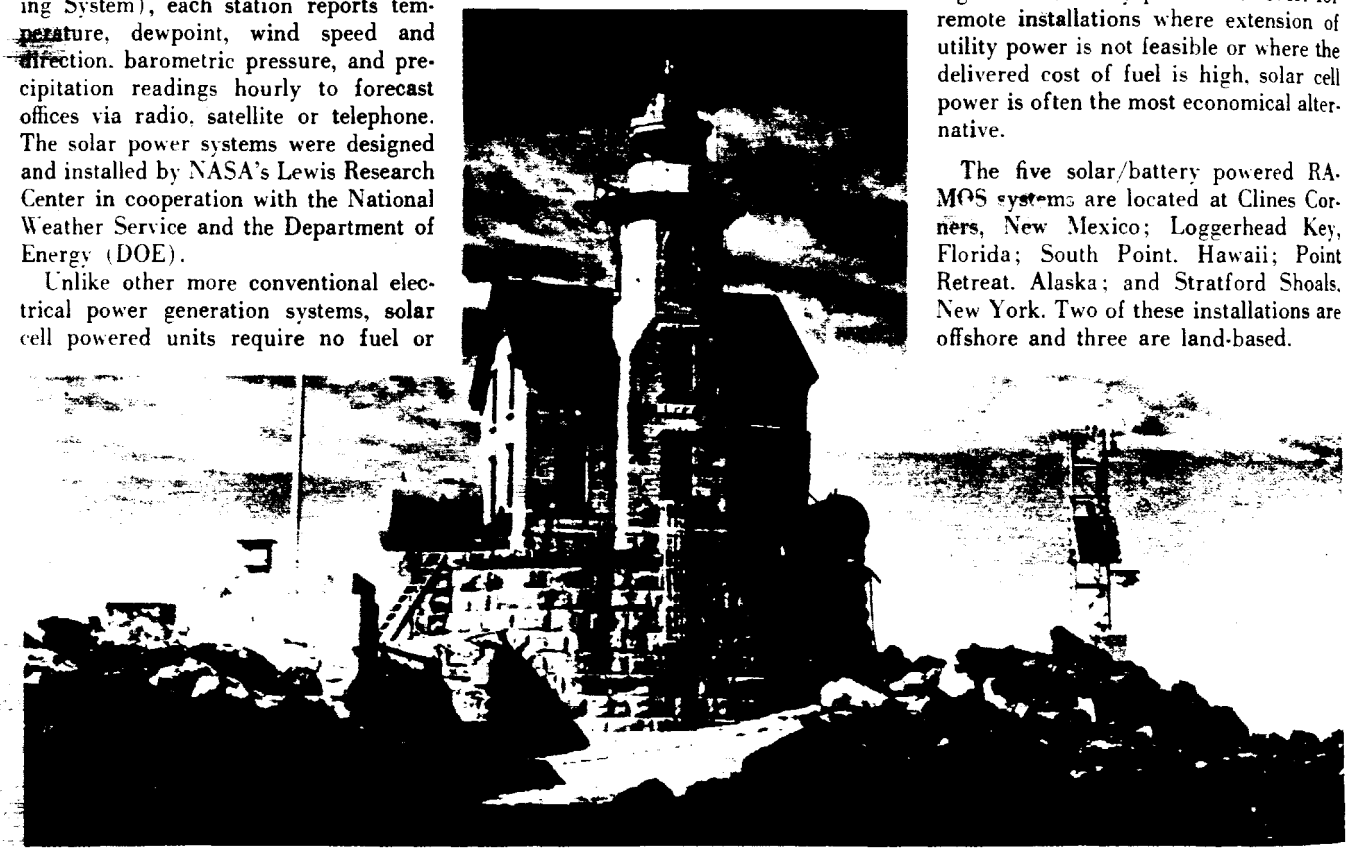


A NASA-Lewis engineer inspects a solar array after six months of flawless operation. These solar cell electrical power generation systems are designed to operate uninterrupted for up to ten years. Batteries store power for operation in cloudy weather and at night.

With no moving parts, solar cells are a simple and reliable means for providing the electrical power needed to keep the RAMOS' batteries fully charged. The number of batteries and appropriate silicon solar cell array in each unit depends on load profile and solar radiation data for each site. In locations of high, consistently available solar radiation, such as in New Mexico, Hawaii and Florida, a relatively small (74 peak watts) solar array was used, backed by an 80 ampere-hour lead calcium alloy, gel/cell battery. At the site with the least solar radiation, Alaska, the largest (148 peak watts) solar array was required, and 1095 ampere-hours of battery capacity was provided.

Complete photovoltaic systems currently cost about $20-$30 per peak watt, and are not cost competitive with existing installed utility power. However, for remote installations where extension of utility power is not feasible or where the delivered cost of fuel is high, solar cell power is often the most economical alternative.

The five solar/battery powered RAMOS systems are located at Clines Corners, New Mexico; Loggerhead Key, Florida; South Point, Hawaii; Point Retreat, Alaska; and Stratford Shoals, New York. Two of these installations are offshore and three are land-based.



Historic, 100-year-old Stratford Shoals Lighthouse on Long Island Sound is the site for the nation's first solar powered RAMOS weather station. Lead batteries store power from the solar cell array shown at right.

Proposed lead-lined container designed to safeguard nuclear waste transportation

Lead has been specified for a key role in radiation shielding for a proposed railway shipping container for nuclear waste. Developed for use in the event that the Government decides to reprocess high level liquid waste from commercial light water reactors (LWR), the container could transport spent LWR fuel from the reprocessing plant to a Federal radioactive waste repository.

The decision to reprocess spent nuclear fuel apparently hinges on the resolution of international safeguards issues associated with plutonium extraction and recycling. If the go-ahead is given, one problem would be devising a safe method of shipping this dangerously radioactive material. Battelle Pacific Northwest Laboratories, which has been researching the problem for the Department of Energy (DOE), has come up with a container that could be adopted to standard railroad freight cars to carry high-level waste in solidified form.

The design of a suitable container for radioactive materials was dependent on a variety of factors or design constraints. These included Federal regulations, the characteristics of the material to be transported, limitations of the transport mode and operating considerations.

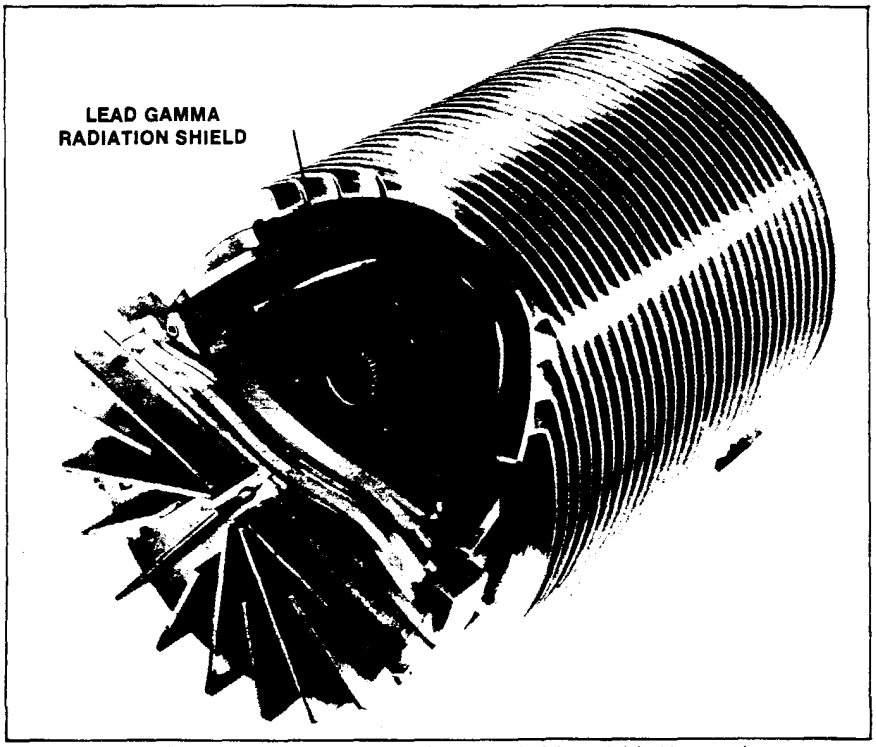
The cask has a capacity of nine canisters of solidified nuclear waste. The maximum heat removal capability of the cask is 50 kw. Heat is removed by natural convection from the cooling fins on the cask body. The loaded cask weighs about 110 metric tons and is shipped on a conventional 6-axle depressed-center flat car that has been modified by the installation of the cask tiedown system.

The body of the cask is a series of concentric shells. The inner wall, constructed of ¾-in. thick stainless steel, is surrounded by a lead gamma radiation shield approximately 8-in. thick. The gamma shield is contained by a 2-in. thick stainless steel structural wall. A 4-in. thick neutron shield surrounds the other structural wall. The body is completed by a ½-in. thick stainless steel outer wall and a series of radial cooling fins ½-in. thick and 4-in. thick.

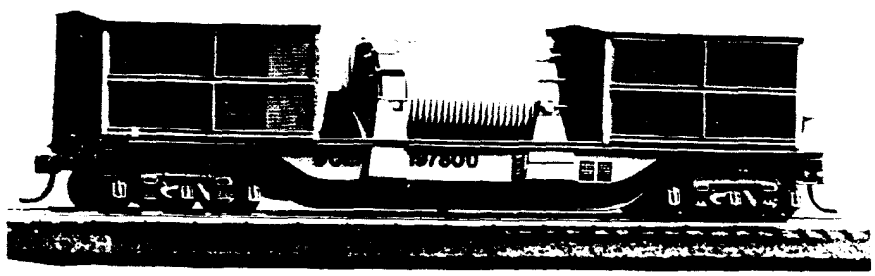
Lead was selected for the gamma shield material in the shell of the cask for the following reasons:

- Lead is generally the least expensive gamma shield material.
- The temperature during operation was well below the melting point of lead.
- Thermal analysis showed no significant melting and resultant loss of shielding during exposure to a ½-hour fire at 800°C.
- The strength of the shielding material was not critical to cask integrity.

The cask tiedown and handling systems are permanently mounted on the railcar. The tiedowns consist of four massive columns that support the cask during shipment. The trunnions on the cask body rest on the support columns. The cask is clamped in place on each end by a steel semi-circular retaining ring that is bolted to the top of the support columns. Energy-absorbing impact fins are welded to the steel rings.

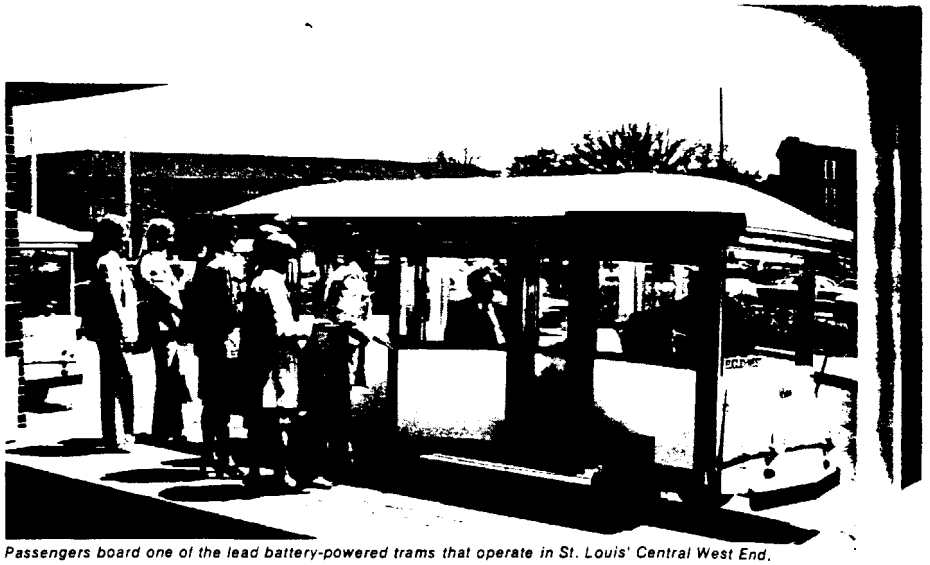


Cutaway of cask for shipping nuclear waste shows lead-lined area which is sandwiched between the stainless steel walls.

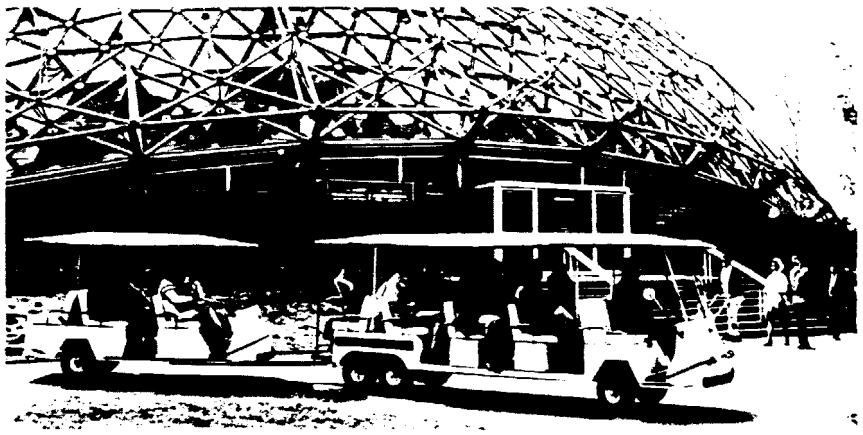


Modified railroad flat car has permanent tiedown system to hold lead-lined container for shipping nuclear waste.

Innovative electric trams revitalize St. Louis community



Passengers board one of the lead battery-powered trams that operate in St. Louis' Central West End.



Lead battery-powered trams are being used to transport visitors on a 20-minute narrated tour of St. Louis' Missouri Botanical Garden.

A battery-powered shuttle service operating in the Central West End of St. Louis, Missouri has proven to be a boon to residents, business people and merchants alike. The shuttle service, consisting of six electric trams and four trailers, transports people to and from restaurants and shops on weekdays from 11 a.m. to 2 p.m. over a route of about three miles. Since its inauguration in 1976 the system has carried over 70,000 passengers.

Called "Electric Fireflies", each tram and its attached trailer carries 16 passengers plus an attendant and driver. Trams have been adapted for all-weather service with permanent enclosures and heating systems.

The tram service is operated by Future Transportation Models of St. Louis, Inc. (FTM), a non-profit organization. FTM does not charge a fare. Merchants along the route help offset the cost of operations with small monthly contributions. In return, the merchants receive boarding passes which are made available to their customers free of charge. Riders can pick up these free passes at any participating shop and board the tram anywhere along the route.

Merchants in the area are highly pleased with the shuttle system. According to an informal poll taken last year, businesses along the tram route reported an increase in business ranging up to 45 percent. In fact, some merchants indicated that as much as half of the noonday business ride the trams.

Ms. Joni Underwood, executive Direcitor of FTM, says that a number of factors have contributed to the system's success. "Our vehicles", says Underwood, "serve the neighborhood and its daily transportation needs in a very personalized way. The trams reduce traffic congestion; do not pollute the air with exhausts or noise, and they are small enough not to dominate the streets. Overall, they are probably the best bargain available in transportation today."

Each electric tram is a tandem axle unit driven by two powerful electric motors powered by a 72-volt lead battery system. The 12 batteries in each unit are 6-volt, 190 amp. hr., and each tram is equipped with a built in battery-charger. Trams and trailers are manufactured by Pargo, Inc., Charlotte, NC, and were purchased through Centron Systems, Inc., a St. Louis firm which sells electric vehicles and specializes in adapting them for particular applications.

Reports indicate that day-to-day performance by the trams in regular traffic situations has been extremely good with trams traveling 20 to 30 miles between charges. Maintenance costs have been low, with more dollars being expended for system development as opposed to regular maintenance. In 19 months they have a perfect safety record while operating every weekday in regular traffic including two of the worst winters ever recorded in St. Louis.

Meanwhile, the Missouri Botanical Garden in St. Louis introduced electric trams this past May to transport visitors on a 20-minute narrated tour of the Garden for $.50. The trams are equipped with 14-passenger trailers which will be enclosed and heated during winter months. They are powered by a 72-volt battery system and driven by two, 2-horsepower GE series wound DC traction motors.

LEAD

The Lead Industries Association is a non-profit trade association representing the lead industry in the United States and Canada. Its membership includes representative firms from all segments of industry and all parts of the world.

The Association neither produces nor sells lead, but collects and distributes information relative to the uses of the metal.

The services, publications and films of the Lead Industries Association are available without charge to anyone interested in the use of lead and lead products.

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LEAD

LIBRARY OF TECHNICAL INFORMATION

The following publications and materials are available free of charge unless otherwise noted. Send request to the

LEAD INDUSTRIES ASSOCIATION, 292 Madison Avenue, New York, N.Y. 10017

ARCHITECTURAL

Lead Roofing and Flashing

Detailed instructions on the simplest and most usual methods for forming or joining lead for roofing and flashing applications. Complete specifications. Diagrammatic drawings. Sixteen pages. A-5

Lead in Building

A four-part data sheet containing information on waterproofing, sound barriers, roofing and flashing and anti-vibration application. A-13

CERAMICS

Facts about Lead Glazes for Art Potters and Hobbyists

Detailed information on the proper formulation, firing techniques, handling, etc. of lead fluxed glazes used by art potters and hobby ceramists. Illustrated. Sixteen pages. B-11

Proceedings of First International Conference on Ceramic Foodware Safety

Top international experts in ceramics, Food and Drug agency officials, and the international lead research community met in Geneva in November, 1974 to discuss heavy metal release from glazed ceramic foodware. Full proceedings—speeches as well as question and answer dialog—were taped, translated and transcribed. 272 pages. B-13

PAINTS

Lead Pigments Bulletin

Brochure, 12-pages, describes the advantages and varieties of lead pigments in anti-corrosion paints. Covers red lead, dibasic lead phopshite, basic silicate white lead, basic lead phosphosilicate, basic lead chromosilicate, basic lead silico chromate. Lists major suppliers. F-7

CHEMICAL CONSTRUCTION & CORROSION PROTECTION

Lead for Corrosion Resistant Applications

Soft cover book, 156-pages, designed to familiarize engineers and engineering students with the corrosion resistance, design and fabrication data on lead and lead-based equipment. Defines plumbum series and corrosion resistance of series. H-6

Lead Chemicals

Soft cover book, 334-pages, is designed as a working manual for the chemist or chemical engineer engaged in applied technology or pure research. Covers organolead compounds, oxides and hydroxides, sulfides and tellurides, halides binary compounds, lead salts, lead chelates, safety in handling compounds. Purchasing price: $3.00. H-7

SOLDERING AND WELDING

Solders and Soldering

New 16-page booklet filled with basic information on soldering and the selection of the right solder alloy for the application. Data is presented on a variety of tin lead as well as other solder alloys. Several case history treatments of typical soldering applications are included. I-6

"Solder Puts It All Together for Manufacturer of Zippo Lighters"

Two-page reprint from Production Magazine details production soldering of lighters at Zippo Mfg. Co. I-7

Soldering of Electronic Products

Booklet covers the use of tin lead solder as a highly reliable joining method in the electronics industry. It includes information on the control of electronic assembly components for solderability, fluxes and flux residue removal, solder alloys and soldering methods. I-8

SOUND BARRIERS

Directory of Acoustic Specialties

Summary of available materials for sound insulation by barrier, damping and absorption methods. Sixteen page list of materials by brand name and manufacturer. Eighteen pages. J-4

Lead a Major Factor in New Machinery Noise Suppression Systems

Description of techniques used to lower machinery noise levels with lead and lead composites. Lists machines that normally exceed noise level allowed by Walsh-Healey Public Contracts Act. Two pages. J-9

Lead Proves a Heavy Favorite as Sound Control Material

A reprint of a feature from Product Engineering illustrating lead's usefulness in sound attenuation to help meet OSHA noise requirements in factories and also on planes and trains. J-17

Specifying Lead for Noise Control

Eight-page reprint contains guidelines to help architects and engineers fully utilize the advantages of lead as a noise control material. A number of case histories are included to show how some of these guidelines were used to solve a variety of commercial, industrial and residential noise problems. J-18

The Use of Absorber/Barrier Materials for Noise Control Enclosures

Four-page reprint is concerned with noise abatement applications within the 10 to 15 dB range. It describes an installation using a quilted absorber/barrier enclosure suitable for achieving these reductions, and presents the advantages of this material. Acoustical, economic, operational and maintenance aspects are considered. J-19

Take a Fresh Look at Noise Control

Two-page reprint from Modern Stores & Offices explains the usefulness of sheet lead plenum barriers for office space noise control. A case history illustrates the needs for an acoustical treatment and cost savings realized. J-20

Modern Uses of Lead in the Construction Industry

This 20-page booklet covers significant uses of lead in construction applications. It deals chiefly with lead for plumbing, waterproofing, roofing and flashing, anti-vibration and sound barriers. J-21

BATTERIES

A Primer on the Lead-Acid Battery

A condensed story of the principles of the lead-acid battery and its chemistry, including some of the fundamentals and definitions of direct-current electric energy. Two pages. L-6

Electrics Get Key Post Office Tests

Reprint of a feature from Electrical World describing tests on the suitability and economy of electric battery-powered delivery trucks for the Postal Service. L-18

Electric Work Vehicles

A 12-page folder describing battery-powered short-haul delivery vehicles and comparing their economics to internal combustion delivery trucks. L-19

Battery-Powered Industrial Trucks Spark Energy and Cost Savings

This 16-page booklet offers an in-depth look at the many factors favoring the purchase of electrics for industrial applications. A pull-out set of work sheets allows the reader to determine how electrics stack up against IC types in his own operation. L-22

Saving Battery Dollars—What You Need to Know

Three-part reprint from Modern Materials Handling deals with proper procedure in picking the right battery for the truck and job. It also discusses considerations in battery charger selection. The third part offers guidelines for planning an efficient battery charging-room layout. L-23

Electric Vehicles: State-of-the-Art 1978

New 28-page booklet contains latest data on electric trucks, buses and passenger cars around the world. Case histories describe EV's in a variety of work applications. Other sections cover energy crisis and pollution problems and their effect on EV's; and the role of lead batteries in EV development. L-24

GENERAL

"Lead Abstracts" and "Yearly Indices"

Quarterly abstract of all current world literature on lead and its products and published research. A general index is published annually. Must be requested on company letterhead. M-2

Primary Lead Production Areas in the U.S.

For schools, libraries. 11"x14" map showing locations in U.S. of most lead smelters and refineries, and lead mines. M-11

The U.S. Lead Industry

An annual review of activity within the industry that contains a general summary for the year and a series of charts and tables giving current statistics on lead production and consumption. M-14

Lead—a Modern Design Material

Summary of properties and available forms of lead for radiation control, sound/vibration control, electrical energy sources, soldering and ceramics. Eight pages. M-15

Ecology in the New Lead Belt

Reprint describes cooperation of industry and environmentalists in developing southern Missouri lead mines. Four pages. M-23

Lead, "The Cinderella Metal"

Booklet is reprint of talk given at the First National Conference on Materials Availability/Utilization. K. C. Hendrick, President, Noranda Sales Corp., a Canadian lead producer, discusses supply and pricing trends for the metal and emphasizes its signficance and value both now and in the future. M-31

Leaded Grades: Answer to Free-Machining Needs

Reprint reports on benefits derived from using leaded steels for free machining. Case histories are employed to demonstrate that these grades can enable partsmakers to raise production of quality components with efficiency and economy. M-32

Lead and Zinc Outlook 1976-1980

Booklet examines demand prospects and production for lead and zinc over the next four years. Current markets and growth applications are also discussed. 16-pages. M-33

Occupational Lead Poisoning . . . It Needn't Be . . . A Manual for Managers

Contains information of use to the industrial manager on the safe handling of lead and lead products in industry. Types and permissible levels of occupational lead exposure are discussed. Some practical controls and safeguards are suggested. 16 pages, bibliography. M-34

Lead and Your Health

Brochure contains advice on occupational protection against over exposure to lead. A checklist of good health practices is included. M-35

Old Paints and Rural Lead Poisoning

Booklet discusses the incidence of lead poisoning among children in small towns and rural areas, a problem usually associated with big cities. The need for lead screening programs to detect and correct the problem is emphasized. M-36

Directory of Lead Casters

Booklet lists 58 companies throughout the U.S. that produce lead products for industry. Data on each firm includes type of casting method products produced and auxiliary services offered. A contact name at each company is provided. M-37

FILMS

Lead in Motion

A 21-min., 16mm color film. Lead's properties and its potential for unlimited future applications are explored from the viewpoint that an atom of lead—like all elemental matter—is an arrangement of energy—part of a universal system. To order specify desired show date and one alternate date. No charge to borrow; viewer pays only return postage. N-2

Occupational Lead Poisoning . . . It Needn't Be

A 16mm, 15 min., sound color film. Narrated by the environmental health experts of international calibre, the film introduces the basic principles of a health program for the lead industry. The intention is to motivate the cooperation of both management and employees in developing an effective health program for their particular operation. To order, specify desired show date and allow one alternate date. Allow at least five weeks for delivery. No charge to borrow; viewer pays only return postage. N-3

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