In 1969, armed with a Federal grant and a pioneering spirit, Scottsdale embarked on a historical journey that led the world into the age of mechanized residential refuse collection. This endeavor was named one of the top 10 projects of the 20th century by the Arizona Chapter of the American Public Works Association. Below is the City of Scottsdale's successful submittal for this award.

History / Background

Scottsdale, Arizona, once a tiny suburb of Phoenix, was incorporated in 1951 with a population of 2,000, a land area of one square mile and the slogan "the West's Most Western Town". In 1964 Scottsdale created a Refuse Division and began providing municipal refuse collection service to its residents. At the time the only way to collect refuse from residential households was by hand. Worldwide, the state-of-the-art technology in the solid waste industry consisted of using rear-end loaders with crews ranging from 2 to 5 employees who manually loaded refuse into the collection vehicle.

In the 1960's Scottsdale's "Refuse Wranglers" rode on "trains" and collected the community's garbage manually.

Scottsdale chose to use a recent innovation in the solid waste industry called the "train system". This consisted of a pick up truck with a removable bed that pulled four open box trailers (the "train"). Each trailer was filled by hand, unhooked and emptied by a front-end loader. Once emptied, the trailers were hooked back together and the driver and his two-man crew were back on their route.

Compared to rear-end loaders the train system dramatically increased productivity to over 90 tons per man per month. Workers could load from both sides at the same time and there was no waiting for a packer blade to clear a hopper. The train system also proved to be a very reliable, reasonably inexpensive & low maintenance method of collecting the community's garbage.

Need For a Change

As with all manual collection systems, Scottsdale's system had a number of inherent problems. In this labor intensive business there was a high rate of employee turnover (91% in 1968). The work was physically demanding. The industrial injury rates were extremely high, wages for manual laborers were very low and image was a problem. Manual refuse collection left the alleys littered with debris, and a menagerie of homeowner supplied containers. Sanitary conditions were marginal at best because many residents stored their garbage in containers with poorly fitting lids, or no lids at all, in temperatures exceeding 100 degrees. The community's quality of life suffered as a result.


Manual collection alleys were unsightly and unsanitary.

While dealing with these issues was something relatively new to the City of Scottsdale, they had been faced by the solid waste collection and disposal industry as a whole for decades. Low wages combined with an extremely physically demanding and unpleasant job made it difficult to attract and retain workers in the solid waste collection field. No one was raising their son to be a garbage collector. An Editorial published in the September-October 1971 issue of Waste Age Magazine briefly touched on this issue. The same issue featured two other pertinent articles. One was on the City of Scottsdale entitled "Mechanized Residential Refuse Collection", which describes Scottsdale's early experimental efforts with mechanization. The second was on the City of Inglewood, California entitled "Humanizing Refuse Pick-up". That article discussed Inglewood's attempt to address some personnel issues referred to above.

Context / Challenges

While mechanization was widely touted by industry experts as the "solution" to the problem, the technology required to develop mechanized collection equipment that was both cost-effective and productive enough to replace manual collection did not exist. There was a great deal of experimentation going on in the late 1960's by both public and private collection agencies throughout the country.

In Texas they tried to automate residential collection by collecting plastic bags from the curb with this boom and claw.

Marc Stragier, appointed Scottsdale's Public Works Director in 1964, was the driving force behind Scottsdale's efforts to improve residential collection technology. With summer temperatures in the alleys often exceeding 120 degrees, collecting garbage was a struggle for city workers. Turnover rates were very high, as some new employees would quit before completing their first day of work. Marc would often go and work alongside the collection employees. This first hand look at the oppressive working conditions made him even more determined to find a better way to collect residential garbage.

Any time equipment salesmen visited Scottsdale, the first thing Marc would ask them was, when will they have an automated collection system? Eventually, Marc talked to George Morrison of Western Body and Hoist, a local equipment vendor, who invited him to look at an automated system operating in Ventura California. The "automated collection system" turned out to be a hydraulic pivot mounted on the side of a Shu-Pak truck which dumped a 55 gallon drum. The operator had to wheel the drum to the truck and chain it to the lift. While Marc was a little disappointed at the "automated collection system", the trip did give him an opportunity to spend a significant amount of time discussing his

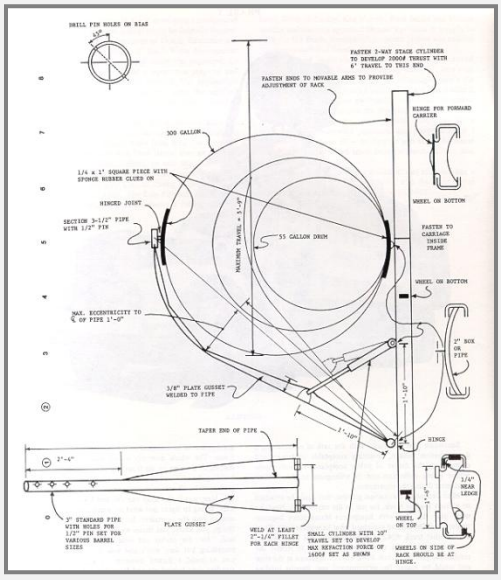
A conceptual drawing of the "barrel snatcher".

idea of mechanizing residential collection with George. About a month later George met with Marc to show him plans he had drawn for a mechanized truck he called the "barrel snatcher". Marc and George drew up some more sketches and presented them to the City Manager, Bill Donaldson, and finally to the City Council. The council approved their proposal to pursue the concept. So Bill Donaldson met with Don Keagy of the Department Health, Education and Welfare to determine if federal funds were available to help Scottsdale pursue their ideas on mechanizing residential refuse collection. The first application was turned down for not meeting the department's criteria. A second application, entitled "Containerization of Family Refuse", was drafted and submitted. In February 1969, Scottsdale was awarded a federal grant.

The grant period extended from March 1, 1969 to June 30, 1972, with funding to be distributed in two Phases: Phase I – to determine whether mechanization was technologically feasible and whether the public would accept the use of city-furnished containers, some used jointly by residents. Phase II – (contingent on the successful completion of Phase I) called for the development of a more sophisticated vehicle, the Barrel Snatcher, to prove that mechanization could work economically.

Innovation

The tasks at hand were now: a) construct a fully mechanized collection vehicle b) design and obtain suitable standardized containers and c) determine the community's degree of acceptance of this new way to dispose of their refuse.



Marc Stragier's sketch was used to build the "grabber".

Marc Stragier had previously drawn up blueprints for a mechanical grabber, which he presented to the City's Fleet Maintenance Division. The grabbers would be built and attached to a standard forklift frame, and the whole assembly would be mounted on the front of one of the City's front loaders that was earmarked for retirement. The forklift frame would be mounted sideways to the front of the truck. The forklift part of the assembly would allow the driver to move the grabbers to the side to engage a container located to the right of the vehicle's front fender. He would then bring it back to the center of the truck, and dump it the same as a front loader would dump a metal commercial bin. The driver could set the can back in place and continue on his route without backing up. Mechanic Chuck Kalinowski was assigned the task of building the grabbing mechanism. As work progressed things didn't always go as intended. On "one of those days", Chuck was verbally venting his frustration and called what he was building "a darned monster, a Godzilla!". Marc happened to be standing close by and overheard Chuck's tirade. From that point forward the mechanized truck was known as "Godzilla".

As work progressed on "Godzilla", Scottsdale conducted a random field survey to establish an average refuse generation rate. The rate would determine the size of containers needed for the project. Four sample 160 gallon containers were obtained from a company in New York, each made with a different grade of polyethylene and molded in the basic conic shape that Marc had conceived. Based on information from the field survey and tests on the sample containers, Scottsdale prepared

specifications and solicited bids for 350 containers in three sizes; 80 gallons for streets, 160 gallons and 300 gallons for alleys. The low bidder, County Plastics of New York, was awarded the bid.

A great deal of time and effort was devoted to the task of determining the public's acceptance of a mechanized collection system. Test neighborhoods for the project were identified. The city worked with Arizona State University's Survey Research Center to contact and provide each household in the test neighborhoods with an explanation of the purpose of the project and directions on usage of the containers. Questionnaires were developed and filled out by the test neighborhood residents before, during and after the six month long demonstration period.

"Godzilla" made its debut in Scottsdale on August 1, 1969.

The shipment of containers arrived at the end of June 1969 and they were placed in the field during the month of July. On August 1, 1969, "Godzilla" made its debut on a collection route. The very first container slipped through the grabbers into the hopper of the truck. For the next six months countless modifications and repairs were performed on "Godzilla" to keep it on the road. There was no back up vehicle for "Godzilla", and, because it was designed to service commercial bins, it took about thirty seconds to empty just one container. As a result, City solid waste and fleet maintenance personnel often worked seven days a week to keep "Godzilla" running and collecting the experimental route. During the six month test period the local media regularly printed information keeping the public up–to-date on the progress of the project.

Analysis following the completion of Phase I of the experiment produced the following conclusions:

- Mechanization was not only feasible, but actually economical for alley collection (Godzilla was too slow on 80's). The most effective service combinations were 80 gallon containers serviced twice weekly for street service, and shared 300 gallon containers serviced twice weekly for alley service.
- Due to a high rate (10%) of container failure, modifications would have to be made to the specifications before additional orders could be placed. The 80 gallon containers with four castors were difficult for residents to roll. The castors were replaced with two rubber wheels so the container could be tipped and rolled like a hand truck. Other modifications were also incorporated into the bid specifications, including changing the molding material to a high density polyethylene to help minimize the breakage experienced with the original containers.
- Resident complaints received from the test neighborhoods were greatly reduced when compared to the number received prior to the demonstration period. In fact, 94% of the test neighborhood's residents said the City was doing an excellent job of collecting refuse in a post-Phase I survey, compared to only 60% when manual collection was provided. Throughout the six month test period residents routinely would line the alleys to watch "Godzilla" gobble up their trash. The City received numerous calls from other residents inquiring as to when their area would receive barrels for trash collection. The results from the test period proved that not only did the community accept the idea of mechanized collection, but that it was actually popular.

Through evaluation, it was determined that Phase I of the project was successful. That meant Scottsdale could begin Phase II.

Phase II of the project called for the development of a more sophisticated collection vehicle, the "Barrel Snatcher", to improve productivity and reduce collection costs. George Morrison of Western Body and Hoist came up with the design for the vehicle and began its construction. The vehicle would be set up similarly to a Wesco Jet front loader with a Diamond Rio chassis, a 37 yard packer body and telephone booth style cab. The truck would be equipped with an eight-foot telescoping lift arm. The lift arm could swing on a pivot from side-to-side and extend to twelve feet in length. The "grabbers" would be built to engage and grab a 300 gallon container, or an 80 gallon container with an adapter added. The "Barrel Snatcher" would be the first of its kind in the world, a fully automated vehicle designed specifically to service a standardized, mechanized residential collection route. It arrived August 1970. In an effort to maintain the high rate of favorable public interest in the project, the City heavily publicized the advancement to Phase II. It also traded on the popularity of "Godzilla" by naming the first truck from the next generation of mechanized trucks the "Son of Godzilla".

Although a whiz in the alleys, the "Son of Godzilla" proved to be inefficient when collecting 80 gallon street routes.

When the "Son of Godzilla", truck # 254, was put into service "Godzilla" was left in service in a back up capacity. Before long it was found that, like its predecessor, 254 was also too slow and too cumbersome to be productive servicing 80 gallons on the street. In order to maintain the existing routes Scottsdale's only rear-loader was fitted with a pneumatic "yoke" designed by Marc Stragier. The yoke could pivot and empty 80 gallon containers into the hopper. The 80 gallons had to be manually pushed into the yoke and removed when emptied. This vehicle was modified to provide a second back up truck. The "Son of Godzilla" had numerous design problems that required numerous repairs and modifications causing a significant amount of downtime. "Godzilla" on the other hand was just plain worn out and could rarely go an entire day without needing repairs.

The "yoke" was reliable back-up, but very slow.

Realizing that it needed a permanent solution for the 80 gallon street routes, Scottsdale submitted another grant request to the Department of Health, Education and Welfare. Money from this grant would be used to develop

and test a truck called the "Litter Pig", which would specialize in collecting street routes and replace the Son of Godzilla, and a mobile transfer station called the "Trash Hog". Western Body and Hoist agreed to help design and build both of these vehicles.

Meanwhile a second, City funded, barrel snatcher was ordered from Western Body and Hoist. The order was followed by an extensive list of requested modifications necessary to correct problems with the first barrel snatcher. During the construction of these vehicles Western Body and Hoist was purchased by Maxon industries, who showed little interest in the development of new equipment. They did, however, somewhat hesitantly agree to honor the existing contracts to build a second and third barrel snatcher and the "Litter Pig" and "Trash Hog".

After several delays the second barrel snatcher arrived in May 1971. Most of the requested design modifications were left unchanged. It became apparent to Scottsdale that any design modifications should be completed in-house rather than continuing to work through Maxon. That decision was a turning point, and would result in Scottsdale entering a new phase in which it would develop and build its own mechanized equipment.

While Scottsdale had "Godzilla's" gobbling up the City's refuse, the City of Tolleson experimented with this "Non-stop Truck".

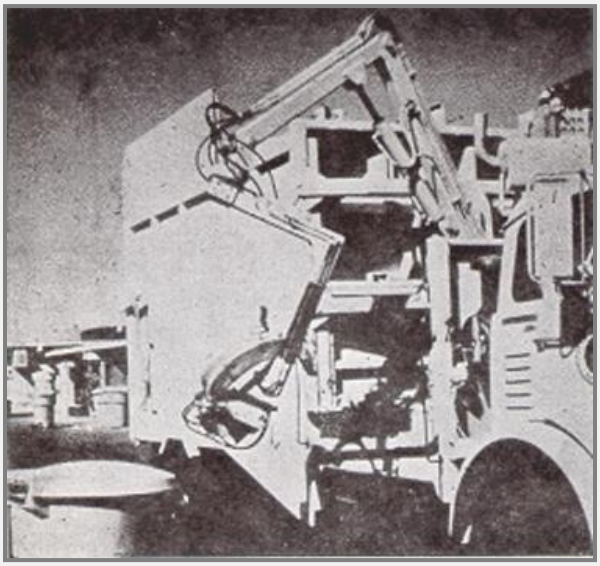
The task at hand, however, was to modify its existing barrel snatchers to make them more productive and reliable. The major areas of concern were the electrical system, the rotary motors used in the arms pivot points, cracked mounting where the arm was attached to the truck, and arm controls that were large , bulky and difficult to use. City employees were asked to come up with solutions to these and other problems that were found, and they were up to the task:

- Both barrel snatchers were completely re-wired to correct the electrical problems.
- The rotary motors were replaced with bearings controlled by hydraulic cylinders.
- The mounting for the lift arm was reinforced to withstand the stress of supporting the lift arm.
- The original lift arm controls were replaced with a modified helicopter joystick to provide easy control of the lift arm movements, 300 gallons could be serviced in 18 seconds with the joystick.

Original controls were replaced by a modified helicopter joystick.

In September 1971, the "Litter Pig" and the "Trash Hog" were delivered. The "litter Pig" was a modified Shu-Pak side loader with right-hand drive that was equipped with an articulated backhoe-style arm. The truck's design was another brainchild of Marc Stragier and George Morrison. The backhoe-style arm was supposed to allow the operator to reach over parked cars and grab 80 gallon containers. From the start, the same design problems experienced with the barrel snatchers became apparent in the performance of the Litter Pig. The biggest problem was the backhoe-style arm. It was very heavy and quite difficult to control. What was supposed to improve the

productivity on the street routes actually decreased it. Even the best operators took anywhere from 30 seconds to well over a minute to service just one container. Again, modifications were attempted to improve the efficiency of the vehicle. A "Maalox moment" occurred during the testing of the Litter Pig when the articulated backhoe-style arm broke off at its mounting base and was left laying in the middle of a residential street until a wrecker could come pick it up. Major modifications were in order. The Litter Pig's backhoe-style arm was replaced with a smaller version of the Son of Godzilla's telescoping arm at Marc's suggestion. John Pickerel, a local metal fabricator and ex-City Councilman, designed and began building the new telescoping lift arm. It was completed by a company called Arizona Special Products. Once attached to the Litter Pig, the new arm proved to be extremely productive, however, it was too frail. Modifications were made by City staff to beef it up and it was reinstalled. An experienced operator could service an 80 gallon container in under 10 seconds. The efficiency of mechanized refuse collection was improving, with the modified Son of Godzilla excelling in the alleys and the modified Litter Pig excelling in the streets.



The "Litter Pig" with its articulated backhoe-style lift arm.

In June 1973, the third, and last barrel snatcher was delivered. Despite Scottsdale's successes, the major equipment manufactures continued to be apathetic about mechanized resident refuse collection. With the experience gained by City staff in performing numerous modifications to its mechanized fleet to date, and due to the problems they were experiencing with purchased vehicles, Scottsdale decided to begin constructing its own mechanized vehicles. The city entered a research and development stage. Scottsdale purchased a used Shu-Pak side loader in June 1973 and modified the vehicle to accommodate a telescoping lift arm. This allowed Scottsdale to continue expanding the mechanized collection areas in the City.

City staff took on the task of building new mechanized collection vehicles to add to Scottsdale's fleet.

Scottsdale was now in a production mode as it began building barrel snatchers from the frame up, and creating "automated sideloaders" by modifying used manual sideloader vehicles it acquired. By 1974 Scottsdale had five mechanized residential collection routes, and only three remaining manual collection routes.

Scottsdale's goal was to replace all of its manual collection routes with automated collection routes. From August 1974 through July 1975, Scottsdale would almost double the size of its mechanized fleet. Scottsdale was convinced that the improvements brought about by their initial and continued experimentation would raise the standards for the solid waste industry. By now, its efforts in advancing collection technology in the solid waste industry had gained world-wide notoriety. Scottsdale's mechanized collection system had been featured in articles in such publications as FORTUNE, READER'S DIGEST,

WEEKLY READER, THE WALL STREET JOURNAL, PUBLIC WORKS, WASTE AGE, NATION'S CITIES and the CHRISTIAN SCIENCE MONITOR, among others. Scores of visitors from around the world, and from both the public and private sectors came to see this new technology.

In October 1974 Russian "technocrats" came to Arizona to get a first-hand look at Scottsdale's mechanized collection system.

Benefits / Changing the Environment

Although Scottsdale did not intend to be in the truck building business for most of the 1970's, the disinterest displayed by the equipment manufacturers made it necessary. Because of Scottsdale's persistence, Marc Stragier's innovative leadership, and the effort of Scottsdale's employees, a new and higher standard of technology would be established for the solid waste industry. By pioneering the mechanization of residential refuse collection, Scottsdale not only improved conditions for its solid waste collection personnel, but the community as well:

- Solid waste collection personnel were no longer manual laborers, but skilled equipment operators whose salaries reflect the skill required to operate mechanized equipment.
- Working conditions improved tremendously, from laboring in the heat and cold to sitting in an air conditioned cab with an AM/FM radio.
- Industrial injuries changed from being a routine occurrence using manual collection, to a virtually nonexistent occurrence with mechanized collection. In 1973 the 9 employees on the three remaining manual collection routes had 18 industrial injuries between them during a 6 month period. Today, industrial injuries are a rarity to employees using mechanized equipment.
- Productivity has increased from 90 tons per month per man for manual collection to over 270 tons per man per month today.
- The alleys and streets of the community are cleaner and more sanitary as a variety of small, unsightly and filthy garbage cans with sharp metal edges and poorly fitting lids have been replaced. Standardized plastic containers are preferred by residents because they are more sanitary, more visually pleasing, and safer for collection employees and residents alike to handle.

- The vast majority of residents prefer the convenience of an automated collection container to using an assortment of cumbersome and dangerous traditional garbage cans.

This sight is rare today as the original container designed by Marc Stragier has been refined over the years and rarely fail.

By the late 1970's a number of equipment manufacturers offered their version of mechanized residential collection equipment, and a number of plastics manufactures offered automated collection containers. The solid waste industry world wide was changed forever.

Today, hundreds of cities across the country use automated residential collection systems, as well as cities in Australia, New Zealand, Germany, Sweden, Finland and Canada. Not too often does the effort of the public sector at the municipal level have such a major impact of an entire industry. For his contribution to the solid waste industry, and his role in helping Scottsdale pioneer mechanized residential collection, Marc Stragier was elected unanimously to the Environmental Industries Association Hall of Fame in 2000.

There undoubtedly have been many worthwhile public works projects completed in Arizona over the last century. What was accomplished in Scottsdale certainly has to rank high among these projects, as the advancement in residential collection technology has improved the environment in communities locally, state-wide, nation-wide and even world-wide!

The evolution of Scottsdale's mechanized residential refuse collection vehicles:

"Godzilla", the grand daddy of them all!
Scottsdale 1969

The "Son of Godzilla"
Scottsdale 1970

The "Litter Pig" specialized in street collection.

The Automated Sideloader
Scottsdale 1974

The Automated Sideloader with a "rail" lift arm
Scottsdale 1978

The Automated Sideloader of today.
Scottsdale 2000's