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Determining a turf area's actual water requirements had been a stumbling block for computer irrigation control.

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ally at the satellite if desired. Each satellite can operate as many as four stations on four programs at the same time. Furthermore, each station can have eight start times and is capable of running three valve-in-head solenoids. Programs can be repeated three times.

The whole key to the system is utilizing increased control to reduce energy and water consumption. Accurately determining a turf area's actual water requirements had been a major stumbling block for computerized irrigation control. Moisture sensors measured small areas. To get accurate information for an entire course would require a multitude of sensors. A way to figure out the amount of water utilized by plants or lost to the atmosphere under changing weather conditions was needed.

Toro assigned the task of finding a practical method of determining ET to Dr. Jim Watson, its chief agronomist. Watson, assisted by five of his colleagues, Jule Meyer, Steve Cockerham and Dr. Vic Gibeault of the University of California at Riverside, and Dr. Jim Beard and Dr. Cornelius van Bavel of Texas A&M University gathered together to work out a method for determining ET for large turf areas.

There are about as many opinions about measuring ET as there are scientists," remarks Terry Mylne, designer of the electronics for the Network 8000. "We took four of the best and built a system based on them." The superintendent can choose from any of the four different ET measurement methods.

The first is based upon temperature. Each satellite has a built-in thermometer. Using this information and an equation based upon the high and low daily temperatures and the latitiude and longitude of the site, the computer calculates the ET. The second method entails a weather station to keep track of solar radiation, temperature, wind speed and humidity. The third utilizes historical weather data and the fourth relies upon agencies that collect and provide ET data on a daily basis, such as the California Irrigation Management Information System (CIMIS) headquartered at the University of California at Davis.

Once ET is determined, the amount of water to be dispersed by each station is calculated by the computer. This is possible because the superintendent has entered the type of nozzle, spacing and other conditions for each station. Values for soil type, turfgrass, soil compaction, pH, shade, wind and sun exposure are assigned to each station. The computer does the rest, although the superintendent can make adjustments to the computer's calculations if he desires.

The feature that may have cinched it for the Network 8000 was double lightning protection. Each station is isolated from the satellite in case of lightning by a surge protector. In addition, there is a back-up fuse for every five stations.

Maloney and Henderson presented McAnlis's plan to the membership. "Eighty-three percent of the members voted for the system," says Maloney. They shared his belief that there is no reason for "mature" courses to take a back seat to new ones. Private courses still have to compete for members.

AquaTurf of Jacksonville, FL, won the bid for the installation of the pump station, the irrigation system and the greens. Since the company is both a golf course construction company and a manufacturer of pump systems, it had a good grasp of fitting all the

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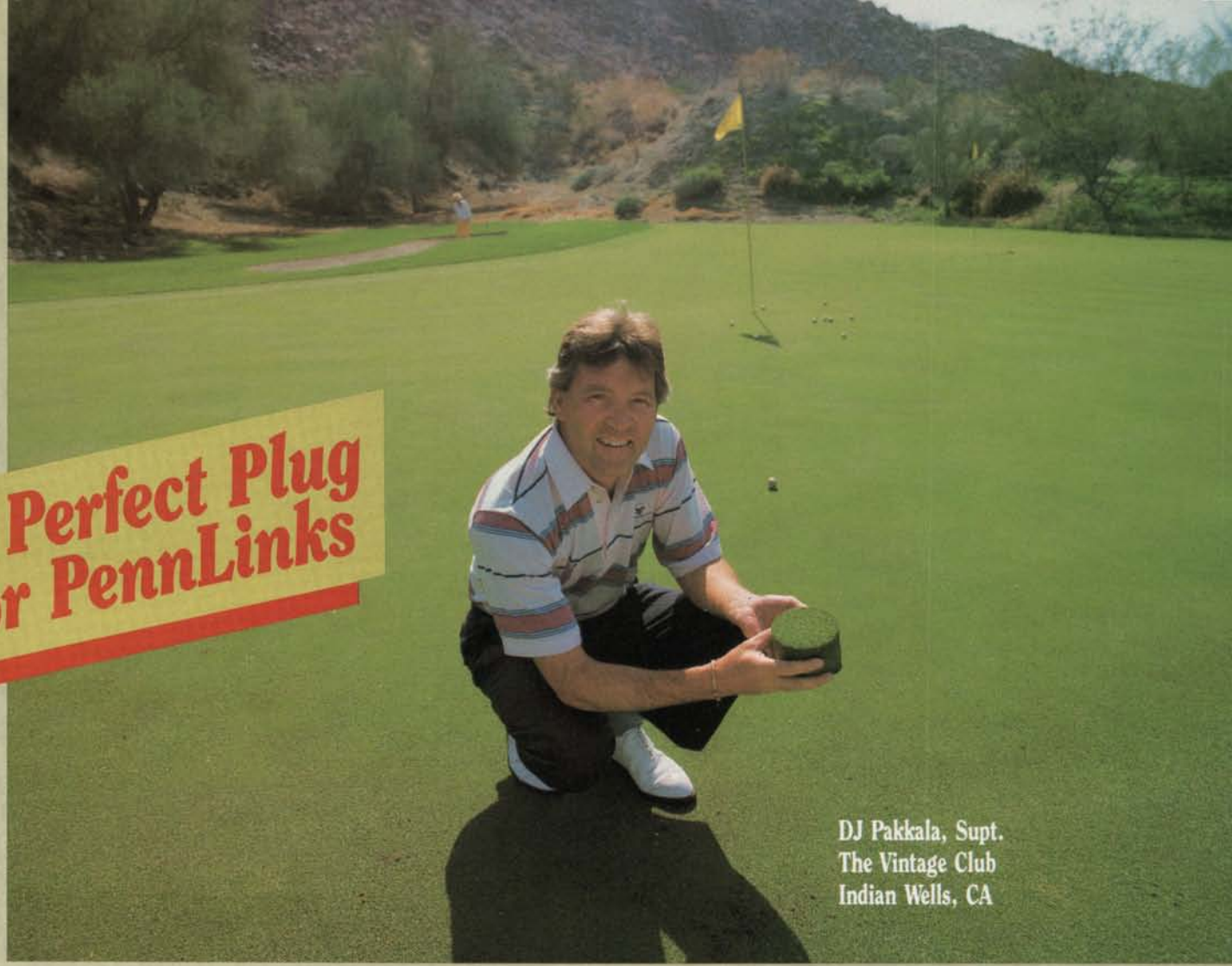

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By inputting the ET data into the central computer, all the watering times are decreased or increased automatically.

All wires, heads and controllers on the east course at Atlantis were replaced. The pipes on the newest of the three nines was left intact.

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components together.

A single pump station with a 25 hp jockey pump, three 75 hp pumps, and a low-speed turbine pump replaced the four old pump stations. To keep tight control over pressure, a hydropneumatic tank, pressure relief valves and microprocessor controller were added. The pump controller was then connected to the Network 8000 system. This provides Henderson with important feedback and historical data so that he can adjust pump and irrigation system operation to decrease energy use.

Like any computerized irrigation system, the more you work with it the more you realize what it can do. Henderson in a few short months has discovered how easy it is to save water and to give every turf area just the water it needs. "We could see the difference between the north and south nines and the east nine in a matter of weeks," he reveals. "Applying the right amount of water to each area makes that much difference."

The Atlantis system uses a weather station for ET information. By inputing the ET data into the central computer, all the watering times are decreased or increased automatically. Henderson can override the program for specific stations if he desires, but most of the specific requirements for each station are already included in the program.

Maloney reports the course saw an immediate 25 percent reduction in energy costs. "We're saving more than we thought we would," he adds. The savings should increase further as Henderson discovers how better water management reduces fertilizer, fungicide and pesticide applications. "Each week I find another way to take advantage of the computer programs," remarks Henderson.

While Henderson is learning the ropes of the first Network 8000 in southern Florida, Rick Sall is one of five or six superintendents in the Palm Springs, CA, area who share their experiences with the system. Sall, superintendent of Canyon Country Club, talks with his computer colleagues weekly. In fact, it was his experience with computerized irrigation controllers that got him the job.

The situation looked bleak at Canyon Country Club three years ago when Dick Ameny took over as general manager. "I took one look at the budget and knew something had to be done about maintenance expenses," he recalls. Expenses were exceeding income for the private 36-hole course.

The course had one of the few remaining quick-coupler systems in the Coachella Valley, the site of more than 65 desert golf courses. Not only did it take three full-time staff to operate the system, electricity and other utilities were costing the course nearly $120,000 a year. "We would start irrigating at 2 p.m. and not finish until 6 a.m. the next morning," said Ameny. The 100 hp pumps on two wells were running 24 hours every day.

'I had to find a way to reduce our utility and manpower expenses fast," said Ameny. Since the electricity was his biggest concern, he called Tom Olson, a specialist in agricultural irrigation for Southern California Edison. The utility company was aggressively encouraging its customers to reduce or shift their electical load to off-peak hours, from 6 p.m. to noon. "He suggested finding a way to cut our energy consumption by running the system at lower pressure at off-peak hours."

A few superintendents in the area had been experimenting with a prototype low-pressure head from Toro. It operated at 50 psi, half the pressure of conventional golf course heads. Less pump horsepower was needed to meet the flow requirements of the head. The larger droplets it produced were also less prone to drifting in the desert winds.

Ameny wanted to know more about the heads and the type of automatic control system that would be needed to run them. He called Roger Gordon, a well-known local golf course irrigation specialist, for professional advice. Gordon discovered that the heads were not yet on the market and put together a state-of-the-art conventional irrigation system for Canyon Country Club that included Hunter heads, Rain Bird valves and a Motorola computerized control system.

Two years in a row the membership would not approve the new irrigation system. Ameny needed more ammunition to convince the members a new irrigation system would save money. It came when Toro finally put

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The greens on the east nine had to be rebuilt because muck soil used to construct them orgInally was causing severe drainage problems.

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The bottom line is the entire course can now be watered in six hours, during off-peak hours.

The heart of the Network 8000 is an IBM/XT personal computer. A phone modem links the computer to the satellites and a printer provides "hard copy" reports.

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the 660 low pressure heads on the market. The company happened to be installing the first Network 8000 systems in the Coachella Valley at the same time. Significant water and energy savings were being reported for conventional systems utilizing the combination of satellites and central computer.

Ameny, who had learned a great deal about irrigation during his two-year search for a solution to the course's energy problem, thought there must be a way to combine the low-pressure heads with the advanced control provided by computers. No golf course had ever installed such a combination. Ameny asked Gordon if it could work. The combination excited Gordon as much as Ameny and the people at Toro and at Pacific Equipment and Irrigation, the local Toro distributor.

With the new design in hand and calculations from Olson at Edison, Ameny went before the members again. He explained the potential 20 percent savings in energy to them, as well as the shorter irrigation time and the ET adjustment for saving water. He strengthened his case with a more efficent pump station and a way to reduce the maintenance staff by three. On paper, the savings added up to nearly $180,000 per year. The system would pay for itself in five years. This time the members said yes.

"We essentially had three months to totally revamp the old quick coupler system," says Gordon. "Most of the club members leave in April or May, so the system had to installed between then and September when overseeding takes place." Another problem was finding someone who had experience with irrigation computers.

A year before, Sall had moved from Ohio to be superintendent of the Palmer Course at Mission Hills Country Club in nearby Palm Desert. Sall had quickly made a name for himself by mastering the predeccessor to the Network 800, the VT-3. Many of the programming functions were similar between the two controllers. Mission Hills also had been testing the low-pressure heads. Toro told Ameny about Sall. Not only did Canyon Country Club offer Sall a huge challenge, it would let him develop an entirely new computerized irrigation system from the ground up. He took the job.

"It took 16 manhours to input all the data the first time," Sall recalls. The computer knows where every head is located, what type of nozzle it has, the site conditions at each head and the type of turfgrass. All heads are identified to fit one of five programs, a greens program, a tee program, a rough program, a fairway program and a bank program. Sall added a sixth program to run the lake aerators.

Meanwhile, Foremost Construction Company was installing the 660 heads, valves, pipes, controllers and pump station for a new well. Previously the course had two small wells, each with a 100 hp pump. A single, larger well would now supply water for the low-pressure heads. The new pump station included a 25 hp jockey pump, one 50 hp pump and one 100 hp pump, a hydropneumatic tank, pressure valves and controller. Instead of producing 115 psi, the new pump station produces 77 psi. The two large pumps only operate at off-peak hours. The jockey pump can supply up to 20 heads during peak power hours.

It all came together in October. Right away Sall utilized the Network 8000's program capabilities to repeat programs up to eight times per day to protect the tender ryegrass seedlings from the dry, desert winds. The year before it had taken the ryegrass two months to get far enough along to allow carts on the fairways. The new system cut this time to five weeks.

ET can vary widely in the desert. Sall feeds information from local weather forecasts into the computer so it can set an ET for the day. "In simple terms, the ET is a precipitation rate measured in hundreths of an inch per day," he explains. "If the heads are putting out .6 inch of water per hour and the ET is .10 (meaning 10 hundreths of an inch of water needs to be applied that day), then the computer will tell the satellites to run for ten minutes. Sall has seen the run time vary from as short as three minutes to as long as 26 minutes.

The feature that Sall uses as much as ET is the "projected flow chart." After he has adjusted the program for whatever reason, the computer takes the start and run time data and constructs a flow chart. A smooth curve means the pumps will not have to cycle on and off to meet water demand. Before Sall downloads the schedule to the satellites at 7 p.m., he can make sure he is not wasting energy at the pump house.

Global adjust is another water-saving feature Sall uses often. If the weather forecast for the day was incorrect and the day is hotter, cloudier or windier than predicted, he can increase or decrease all the program run times by a percentage figure. "If we get a short rain or clouds move in, I'll globally adjust the programs down by 50 percent," explains Sall. "On a very hot day I'll raise it 150 percent." He can override any program if he needs to by giving an "operator selected" command.

The bottom line is that the entire course can now be watered in six hours, the money-saving off-peak hours between midnight and 6 a.m. Furthermore, for every pound of pressure saved by the heads, the energy bill drops approximately one percent. For Canyon Country Club, the two items add up to a yearly savings of more than $40,000, according to Ameny. To make the deal even sweeter, Edison gave the course a $45,000 rebate for investing in energy-saving technology. In water, savings the first year amounted to 16 percent less acre feet.

Word spreads fast in the desert and both Sall and Ameny have been getting calls from other courses. Energy savings and incentives from the electric company are catching nearly everyone's attention.

Like Henderson, Sall is getting more out of the computer programs each week. The number of Network 8000 systems in the Palm Springs area is now over five. The number of courses switching to low-pressure heads is also growing.

Unlike Henderson, Sall has superintendents nearby to discuss his experiences with the system. They talk by phone regularly and help each other out. They know they are part of a special group, the first superintendents to try this new technology. But, most importantly, by combining their knowledge of turf management with advanced technology they are are changing golf course management.

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TIPS FROM THE PROS

ATLANTA STADIUM TACKLES SAND WITH WATER FILTER

When 59,000 fans go to an Atlanta Falcons football game, water is one of the things they generally take for granted. They don't realize that up to 1,700 gallons of water per minute flow into Atlanta/Fulton County Stadium during a game to supply concessions, restroom facilities, locker rooms and field crew. The fact is no stadium can operate without a reliable supply of water for more than a few minutes.

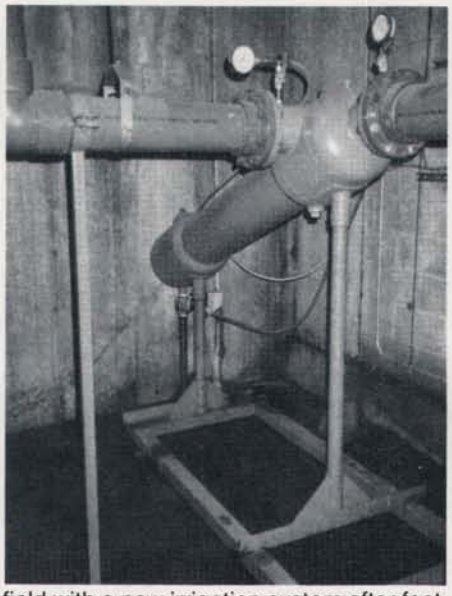
This became painfully clear to David Doane, plant superintendent at the stadium during the 1986 football season when, "It seemed like more sand was flowing out of the drinking fountains and faucets than water." The sand clogged faucets and soft drink dispensers in the concession areas, jammed flush valves in the restrooms, scared fans (who couldn't get a soft drink) from water fountains and made irrigation valves stick open. The problem was so serious that the Falcons were threatening to withhold their rent. Fans were up in arms. Local sportswriters made the stadium's plumbing a city-wide issue.

The stadium had operated for 21 years without any problem, explains Doane. It wasn't until construction began on a highway interchange next to the stadium during the summer that problems started to occur. "We didn't notice anything right away," Doane recalls, "even though construction crews were relocating water mains next to the stadium. Little things would happen, like stuck irrigation heads or toilets, but nothing seemed serious."

When more than 50,000 fans filled the stadium for a September Falcons game, the high volume of water being used in the concessions and restrooms flushed the sand in the water mains into the stadium. Within minutes the flush valves on more than 200 toilets froze open causing the water pressure in the top two stadium levels to drop to zero. "The water was also pouring into the sewer lines faster than the pipes could handle it," states Doane. "We had no water on the upper decks and six inches of water on the floor of the clubhouse level. We had to shut off the water to half the restrooms on the lower levels to get the water pressure up to the upper levels. It was a mess!"

After the game, Doane's crew repaired the valves, flushed out what sand they could and washed all the carpets in the clubhouse level. The problem reoccurred the next two games despite the extra precaution taken to prevent it. The Falcons and the fans were out of patience.

The stadium was planning to install a PAT



field with a new irrigation system after football season ended. It would have been the ideal time to make plumbing repairs, but Doane couldn't wait any longer. He had less than three weeks before the next Falcons game to solve the problem.

"We worked on several different ways to protect the stadium from sand in the water," explained Doane, "and decided to install two separators and basket strainers in the mains." The separators were air shipped by Lakos in Fresno, CA, to Atlanta and installed. A second major main was installed to divide the restrooms from the rest of the stadium. All water entering the stadium is now filtered, including irrigation water used by the new PAT System.

The centrifugal-action separators have no moving parts to wear out nor screens or filters to clean or replace. They can be purged of silt and sand with an automatic valve. Routine maintenance or backwashing are not required. "They seem to remove at least 95 percent of the sand no matter what the flow rate happens to be," says Doane.

Construction continues today on the highway interchange but Atlanta/Fulton County Stadium has had no further problems. The fans, the stadium engineers and grounds crew can now concentrate on the game without worrying about the water.

TRUMAN SPORTS COMPLEX KEEPS OUTSIDE AS SHARP AS THE INSIDE

While the acre-and-a-half of turf inside most stadiums receives nearly all of the attention, grounds managers usually have another 30 or more acres of landscape to maintain outside the stands. These consist of parking islands, entryways and roadsides which take as much or more abuse than the field.

Truman Sports Complex in Kansas City, MO, is the site of two side-by-side stadiums surrounded by 65 acres of landscaping. To George Toma, director of fields and landscaping, the appearance of the landscaping outside Arrowhead and Royals Stadiums is just as important as the condition of the surfaces inside each stadium.

Keeping the surrounding landscape in condition has its challenges. "The wind blowing off the asphalt parking lots in the summer reaches triple figures," states George Toma, director of fields and landscaping. Nevertheless, Chiefs and Royals fans frequently pick shady spots on the parking islands for picnics and tailgate parties.

The 27 parking islands, designed to break up a sea of asphalt, vary in size from 2,500 to 10,000 square feet. The sloped mounds were installed without irrigation and are difficult to mow or aerify. "My guys had to drag 300 feet of 1½ inch hose across the lot everyday during the summer to water the islands," Toma remembers. The water would run down the slopes leaving the top of the mounds dry and the bottom wet. The native clay soil would not absorb the water fast enough to prevent runoff.

Toma, who uses his inventiveness and experience every winter to help the National Football League prepare a stadium field for the Super Bowl, needed a way to increase the infiltration rate of the soil so he could reduce watering frequency. He tried a wetting agent (Aqua-Gro) on a few of the islands. The crew could tell which islands had been treated since those islands stayed green days longer than the others. "My crew pleaded with me to treat all the islands," said Toma. "We were able to cut down hand watering from daily to twice a week."

"I train my guys to be creative and to combine tried-and-true methods of sports turf management with new ones when they can," says Toma. "That way they'll be able to handle almost any challenge thrown at them."

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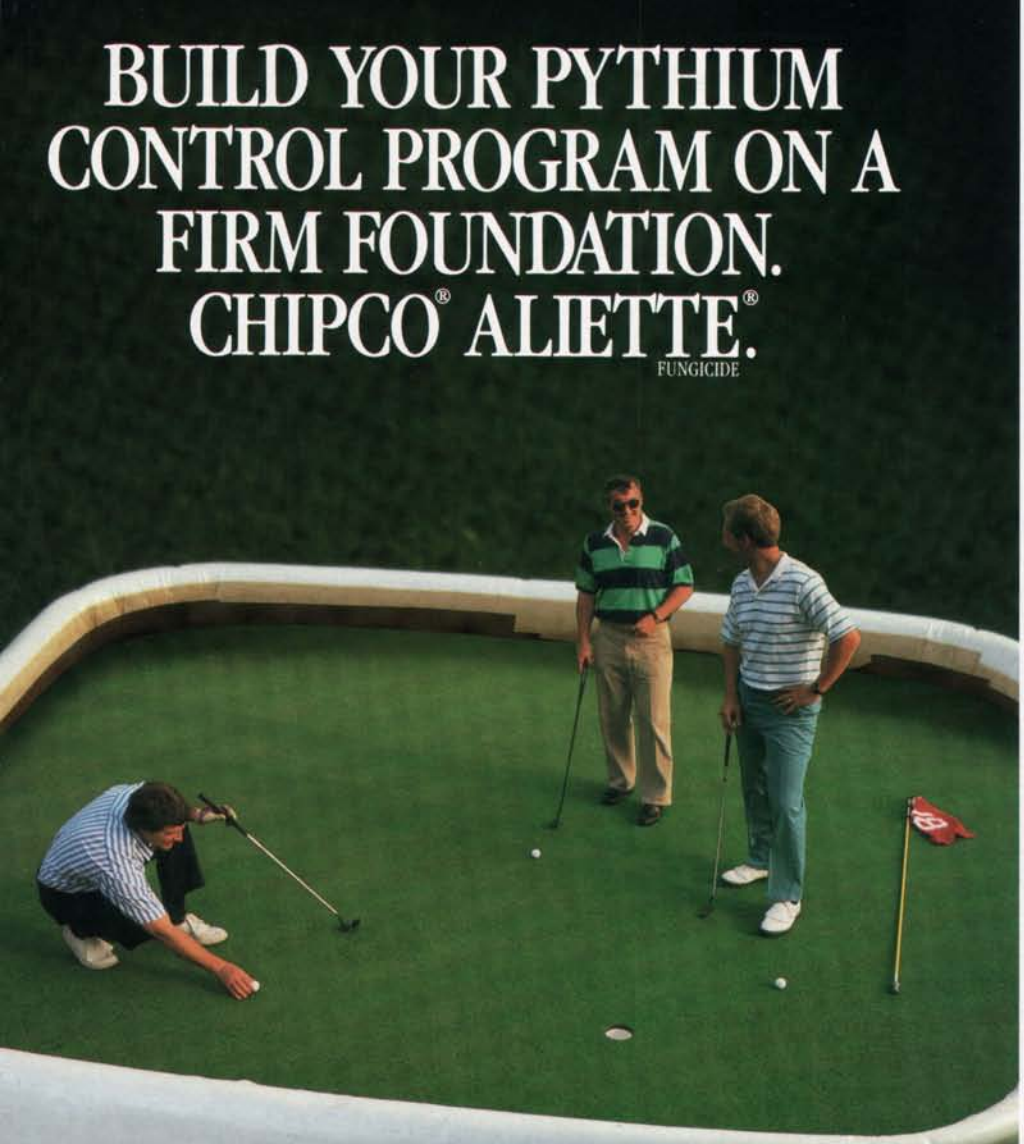

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