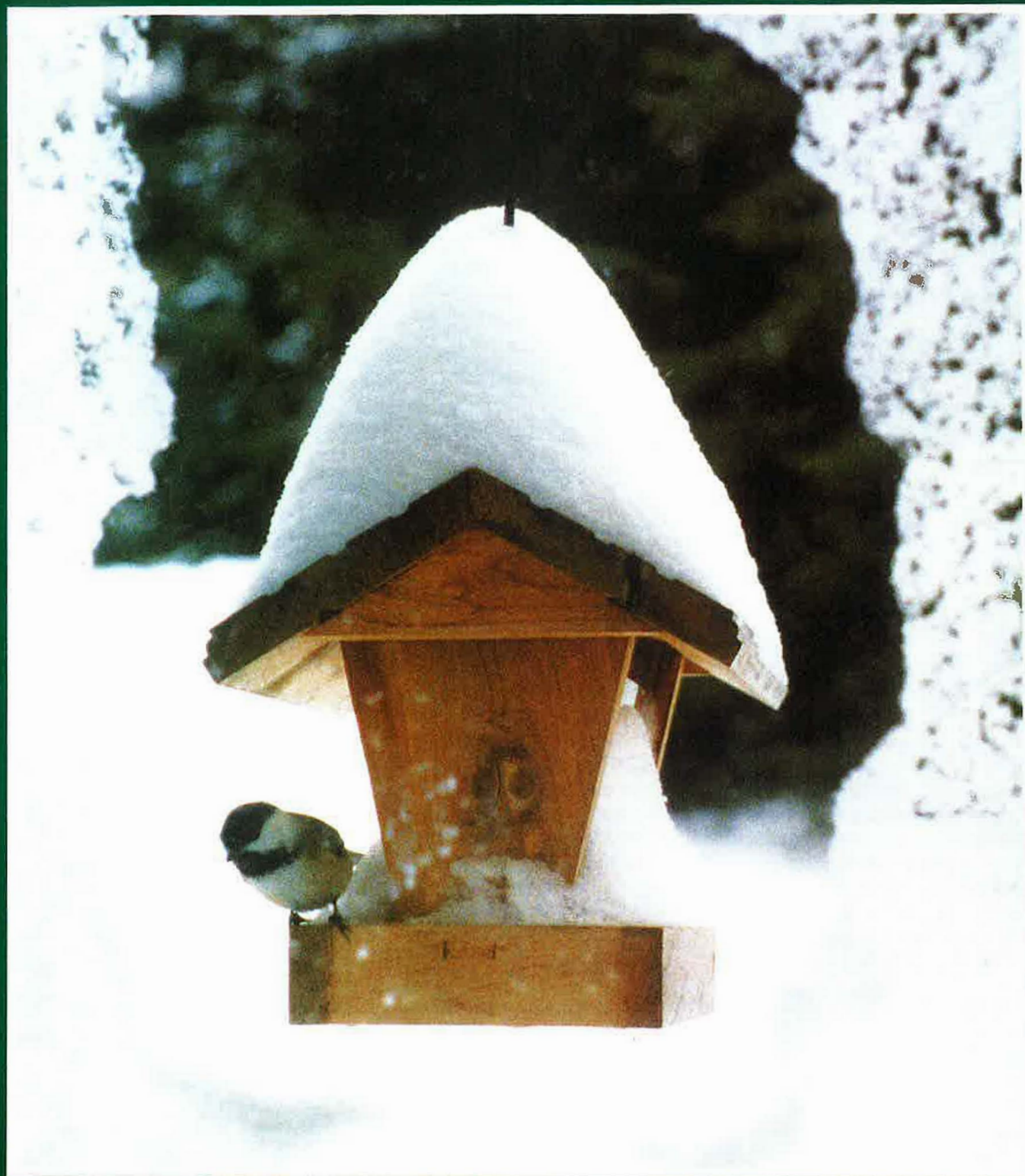


SOLAR SYSTEM ON ROUTE 1 • ST. JOHN VALLEY FARMS • WINTER FUN

E·C·H·O·E·S

No. 75

Rediscovering Community



A POW RETURNS • DISCOVERING PORTAGE

\$5.00 (\$6.00 in Canada)



Volunteers steady the 1,000-pound replica of Saturn after lifting it from the truck in preparation for hoisting it onto the post beside U.S. Route 1 north of Mars Hill, Maine.

MANY HANDS

Volunteers put the Maine Solar System Model on the map

by Kevin McCartney

Since its completion in June 2003, the Maine Solar System Model has become a major tourist attraction in Aroostook County. The project has brought national and regional attention to northern Maine through magazine, newspaper and broadcast media coverage, in large part because of the way the model was built. This model did not develop from a major grant or corporate sponsor; it was built entirely by donated local resources. Altogether, more than 650 citizens from Aroostook County, including students from 12 schools from Limestone to Sherman Mills,

were involved in the construction. The model is a statement of Aroostook's "can-do" work ethic.

The idea of building a large solar system model was first posed by a colleague at the University of Maine at Presque Isle (UMPI). He remembered a school project in Washington State that had signs representing planets set at scale distances along a north-south running road that was "just like Route 1 in Maine." The idea sat in the back of my mind until a check of the odometer during a business trip showed the distance along U.S. Route 1 from the university

campus to I-95 to be about 40 miles.

The 40 miles from the museum to the interstate highway was significant because the number of astronomical units from the Sun to Pluto is 40. An "astronomical unit" (AU) is the distance from the Sun to the Earth, or 93 million miles. Astronomers commonly use this as a scale for objects in the solar system. The earth is 1 AU from the sun, Jupiter is 5.5 AU from the sun and so on (see table on page 24). The 40 for both distance in miles along U.S. Route 1 and AU to Pluto makes for a very convenient scale of 1 mile = 1



KEVIN MCCARTNEY

Sonny Michaud doing the final welding work for Venus.

AU. The Northern Maine Museum of Science would be a logical starting place for the solar end of the model. The Maine Department of Tourism's Houlton Visitor Information Center, just off interstate 95, would be an obvious site for Pluto, with the remaining planets spaced at appropriate intervals between the two.

A solar system model is not unusual. Indeed, the Northern Maine Museum of Science already had one running the length of the second floor hallway in Folsom Hall where the museum is located. But this model, like many, uses two scales. One scale is used to show the distance from the sun and a different scale is used to show the size of the planets. The illustrations in science textbooks and solar system posters typically use two scales, with planet diameters much larger in comparison to the distance between planets. For the museum's existing model, the distances are shown at 1 meter to the astronomical unit, or 1:150,000,000,000. But at this scale, the large planets would be very small and the

small planets would be microscopic. So for the hallway model the size of the planets is magnified 300 times to 1:500,000,000.

If the 40-mile Maine Solar System Model used one scale for distances and diameters, the largest of the planets, Jupiter, would be five feet across and small planets would still be large enough to be seen at a distance. Such single-scale models of the solar system are unusual, and the 40-mile model would be about one third larger than the largest complete existing model: the approximate 1:128,000,000 model in Peoria, Illinois.

But how would the models of the planets be constructed?

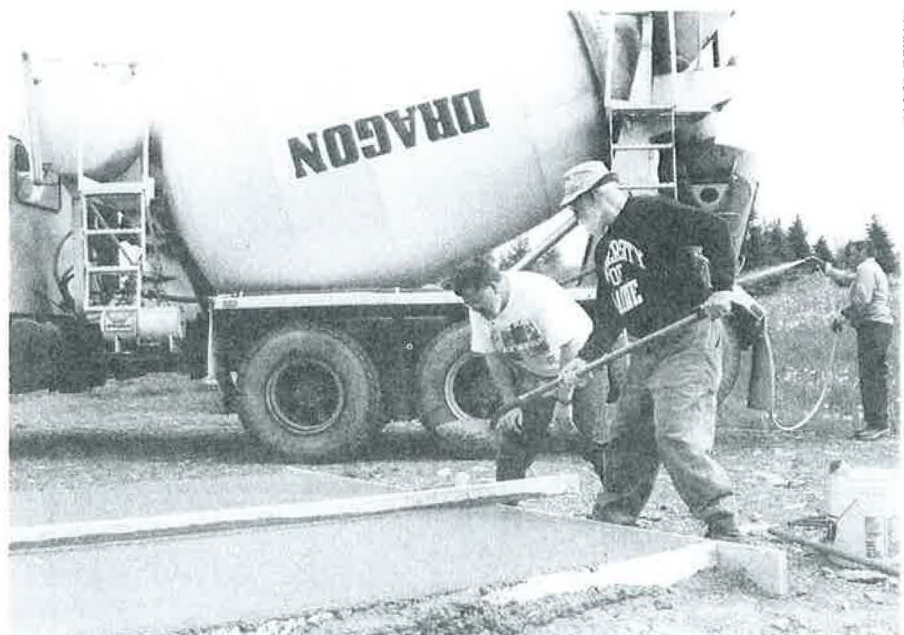
An important precedent had already been established in northern Maine. Two monuments built in the early 1980s commemorate historic balloon crossings of the Atlantic Ocean. The *Double Eagle II* launched from a small field south of Presque Isle in 1978 and the *Rosie O'Grady* lifted from a field south of Caribou in 1984. The communities of Presque Isle and Caribou built large outdoor models at each launching site. The models measured about seven feet wide and more than

15 feet tall and were built by local high school technology programs with donated materials. These monuments showed that large 3-D models could be constructed and that students at local schools could do the construction. The two models were constructed differently, which offered information on contrasting designs, materials and the effects of weathering.

Organization

It was understood from the beginning that this huge project would require hundreds of people, all of them volunteers. Perhaps the most important part of the project would be finding volunteers with track records of getting things done. One of my first contacts was James Brown, director of planning and development for the City of Presque Isle. It was a fortuitous choice. Brown suggested that we immediately go to his truck and drive down U.S. Route 1 to see where the planets might be located, which we did. All of the planets were in "doable" locations.

The next task was to bring in Terry Hannan and Brent Bubar, local representatives of the Maine Department of Transportation (MDOT), to dis-



CAROL REEVES

Jim Berry and Richard Watson work on the cement foundation for Saturn.

DETAILS ON THE MAINE SOLAR SYSTEM MODEL

Object	Diameter		Distance miles*	Tilt degrees
	cm	inches		
Sun	1519	598 (50')	0	0
Mercury	5.3	2.1	0.40	0
Venus	13.2	5.2	0.73	2
Earth	13.9	5.5	1.0	23
Moon	3.8	1.5	*192 (16')	
Mars	7.4	2.9	1.55	24
Jupiter	156.1	61.4 (5')	5.28	3
Io	4.0	1.6	*182 (15'+)	
Europa	3.4	1.3	*289 (24'+)	
Ganymede	5.8	2.3	*461 (38'+)	
Callisto	5.3	2.1	*811 (67'+)	
Saturn	131.9	51.9	9.69	26
inner ring	159.6	62.8		
outer ring	298.4	117.5 (10')		
Titan	5.6	2.2	*526 (43'+)	
Uranus	55.9	22.0	19.51	98
Neptune	54.1	21.3	30.59	29
Pluto	2.5	1.0	40.14	96
Charon	1.3	0.5	*8.5'	

* for moons, distance is in inches (feet) from planet.

cuss the project and the implications of its presence along U.S. Route 1. Terry and Brent agreed that the project was doable, providing that landowner permissions were obtained and that all structures were outside the right-of-way, typically 50 feet from the center line of the road. Jupiter and Saturn, however, would be large enough that tourists would likely stop and take pictures. Neither location was near a place where people could pull off the road, except for the emergency lane, which could not be used for that purpose. Parking lots would need to be constructed at these two sites.

Three community meetings were held at UMPI during the summer and early fall of 1999, in which the growing group of planners and advisors of about 20 people discussed the project. Sources for funding were also debated. We quickly agreed that we were more likely to find success if we did not seek corporate or other large sponsors, since the materials, services and landowner permissions would be given freely if it was understood that this was a community project with a zero budget.

Design and other considerations

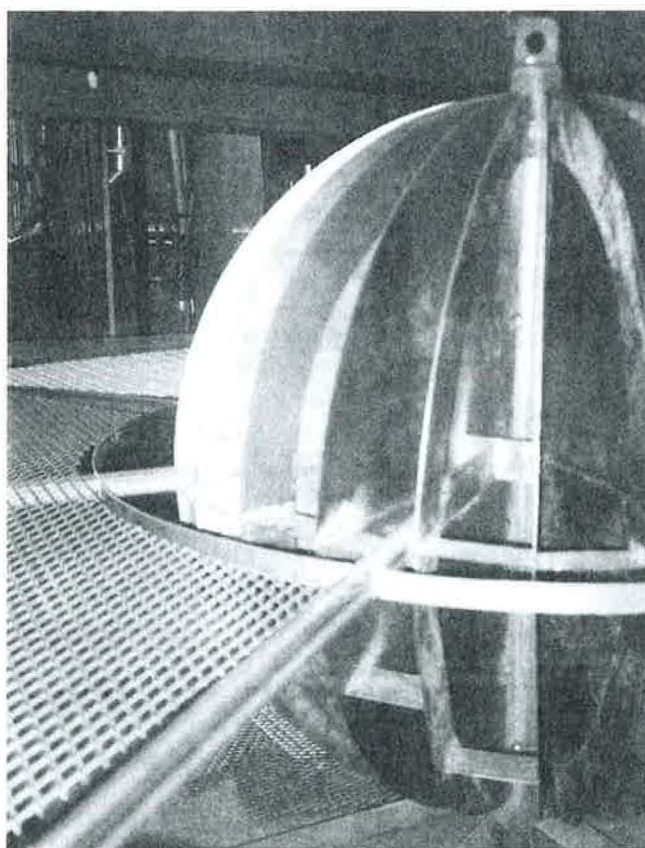
We agreed early in the project that the planets should not be depicted by signs or billboards, but rather by 3-D models. With the balloon models our communities had demonstrated the ability to build structures of that size without funds. We only needed to determine how to do it again. Lynn McNeal, Director of the Caribou Regional Applied Technology Center (CRATC), which had built the Caribou balloon monument, and his high school teachers and students were willing to

take on the solar system project and became essential participants. They would design and build the two largest planets.

Since the Sun, Pluto and its moon, Charon, would be exhibited indoors, they could be made of wood, but the outdoor objects needed to be built to last 50 years, be maintenance-free for 20 years and be able to withstand the high winds of the worst storm. The planets would be positioned on metal posts 10 feet above ground level and usually at a distance of 55 feet from the center line of the highway.

Each of the outdoor planets would have a concrete base, while the moons would be on posts that lacked a base. Each planet model would also show the tilt of its axis. Six moons — four of Jupiter, one of Saturn and the earth's moon — were considered large enough to be readily seen from the highway, and these would be shown at scale distance from their respective planets.

The task of talking with landowners was given to a site committee consisting of Eddie Hews, Perley Dean, Dr. Alvin Reeves and myself. Permission to put planets at some locations was easy to obtain. Burrelle's Press Clipping Service in Presque Isle was happy to host Mercury and Percy's Auto Sales readily accepted the Earth. Other locations were more difficult. Five sites



Saturn, like Jupiter, was made of welded metal plates put together as pie sections. Metal beams supported the rings, which were made of a metal grill.

were researched for Jupiter before an acceptable location was found. Fortunately, the somewhat elliptical orbit of the planets provided some “wiggle” room in choosing the location. Locations for the largest planets were usually surveyed by B. R. Smith Associates, Inc. Where needed, contracts were drawn up by lawyer Frank Bemis. All of this was done without charge.

The only object in the Maine Solar System Model that is not 3-D is the Sun, whose scale diameter is 49½ feet. To show the size of the Sun, a large arch was designed to extend from the first to the third floors of the Folsom Hall entryway. Most of the rest of the Sun could be painted on first, second and third floor walls that extend behind the arch, showing the full diameter, with the equator five feet above ground level on the first floor. The 22-foot arch, which included lights inset into the leading edge, was made of wood and built by UMPI’s master carpenter Claude Boucher.

Construction

Northern Maine is blessed with high school programs that include welding, fiberglass, masonry, heavy equipment and art. Three schools constructed planets, three schools built metal posts, and four schools painted planets and moons.

The Jupiter and Saturn sites, including moons

continued on page 40



LARRY AVOTTE

Mars rises above the east side of Route 1 about 1.5 miles south of the University of Maine at Presque Isle on a crescent showing the tilt of the axis.



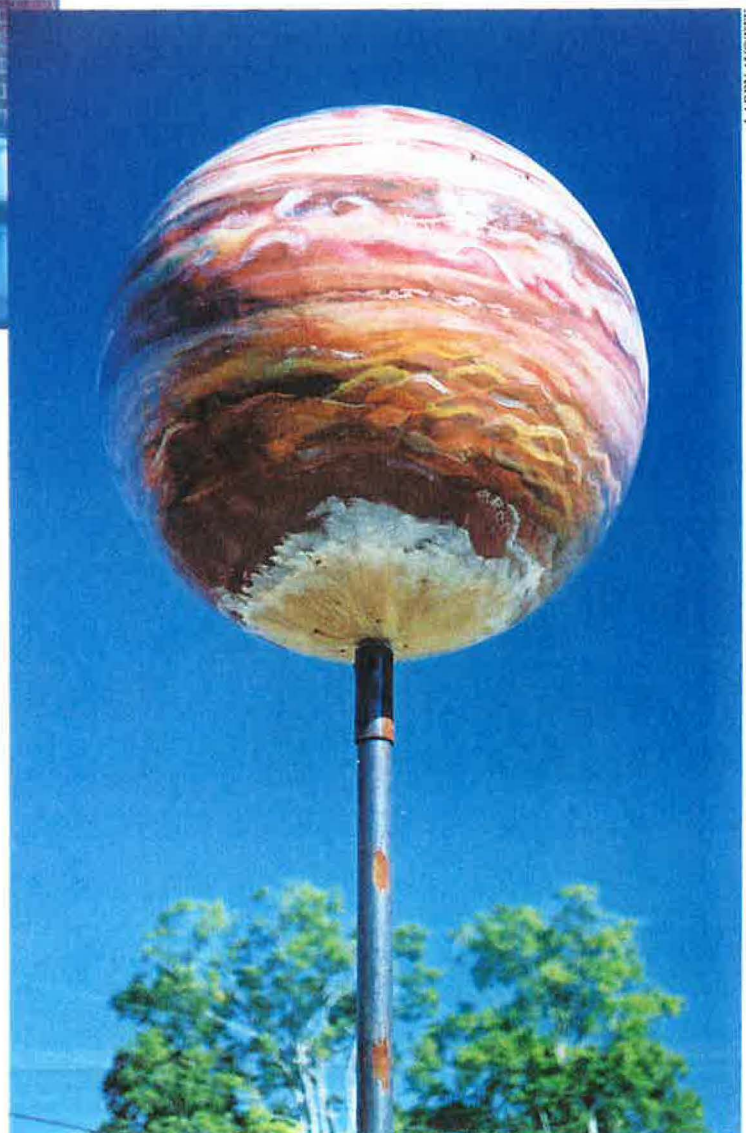
KEVIN MCCARTNEY

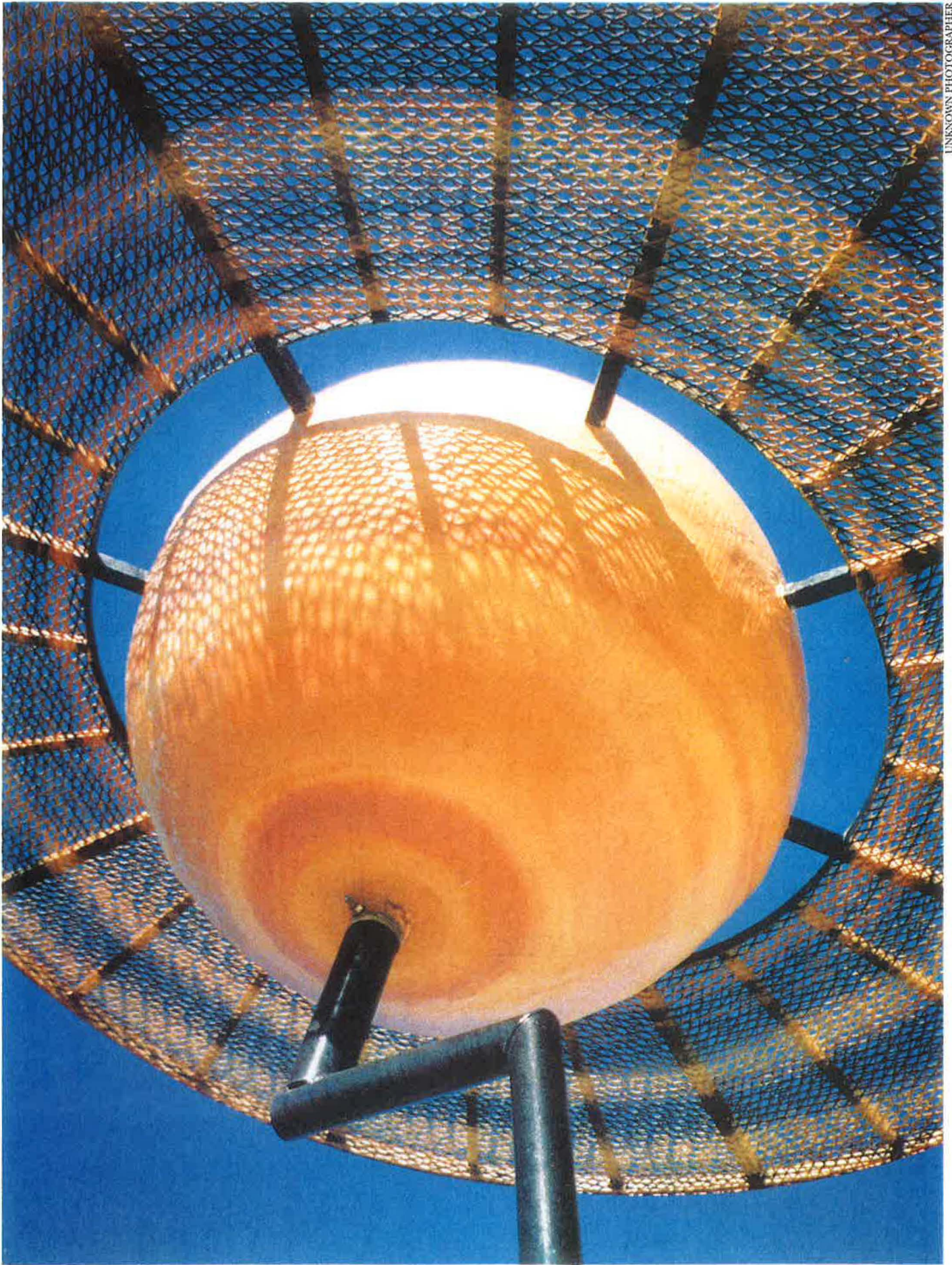
Students from Limestone Community School paint Jupiter.



The 40-mile-long Maine Solar System Model begins with a 22-foot arch representing the Sun extending from the first to the third floors of the Folsom Hall entry at the University of Maine at Presque Isle, home of the Northern Maine Museum of Science. The model ends in Houlton at the visitor information center near Interstate 95. One mile along U.S. Route 1 equals the distance from the Earth to the Sun, known as an "astronomical unit." Our Sun is a typical star in its middle age with temperatures hot enough to sustain fusion — the combination of hydrogen atoms to form helium in a process that releases heat and light.

Jupiter, located about 5.3 miles from UMPI on the west side of the highway, is the largest planet in the solar system. The hand-painted model is 61.4 inches in diameter and shows an atmosphere with many storms. Four of its many moons — Io, Europa, Ganymede and Callisto — are located from 15 to 67 feet from the planet.





Saturn and its largest moon, Titan, are clearly visible on the east side of Route 1 about 30 miles from Houlton, just north of Mars Hill. The model is 52 inches in diameter and a metal grill depicts Saturn's prominent rings, which are thought to be made of ice.

MANY HANDS

continued from page 25

and grounds, were each the work of six different schools. The Loring Job Corps Cement Mason Program, under David Tardie, built all the concrete bases.

Venus and Earth were made of a fiberglass covering over a styrofoam ball, carved to the correct diameter, with a metal rod in the center to give it structural strength. Mars was a fiberglass covering over a hard rubber baseball. The fiberglass work for all the planets out to Saturn were done by Ken Westin's auto body classes at CRATC. The six moons all closely approximated the diameters of billiard and golf balls. The billiard-ball sized objects, which also included the planet Mercury, could be drilled and painted with no additional work needed. The golf ball-sized moons were drilled and covered with fiberglass before being painted by Jeanie McGowan, coordinator of outreach for the Northern Maine Museum of Science.

Jupiter and Saturn were both made of welded metal plates in pie sections that form the outline of the sphere. The areas between the metal plates were filled in and covered with foam and then sanded down to form a spherical surface that could be covered with fiberglass. The welding was done by Kevin Quist and his welding students at CRATC. Metal beams were positioned through the structure of Saturn to support the rings, which were made of a metal grill.

The job of moving Jupiter and Saturn was done by Tom Huston and his large equipment operation and maintenance classes at CRATC. Each planet weighed more than 1,000 pounds, and their large size

required the use of lowboy tractor trailers. Such trips were required a number of times, as Jupiter was moved to Limestone Community School for painting by Tom Cote and his K-12 art students, then to Presque Isle's Skyway Industrial Park for storage prior to being moved to the site. Saturn was moved to the Fort Fairfield Middle/High School for painting, then to UMPI for additional painting prior to being moved to its site. Two of Tom Huston's students, Joshua Forcier and Chris Demerchant, also built the parking lot for Jupiter during their harvest break.

Sonny Michaud and his students at Northern Maine Technical College (now Northern Maine Community College) built the posts for Mercury through Jupiter, and Earth's moon. For the small planets, a one-foot diameter crescent-shaped structure was used to make the planet more visible and show the tilt of the axis. The posts for the five moons of Jupiter and Saturn were made by Bruce Crandall and his students at the Southern Aroostook Vocational

Education School District in Sherman Mills. The Uranus and Neptune posts were made by Rodney King and his students at the Southern Aroostook Vocational Technology Center at Houlton High School. The post for Saturn was built by local welder Fred Haines from Haines Manufacturing in Presque Isle.

Several individuals did considerable work at specific sites. Jim Berry and Richard Watson coordinated the construction of the parking lot and gardens at Saturn. Michael Clark, along with Darrell Malone and Bob Aucoin, coordinated the work for Uranus and Neptune, which were built by Rodney King, Clint Cushman and Ammie Toby at Southern Aroostook Vocational Education High School, in Houlton.

Building and Unveiling

Even though the project was accomplished on a zero budget, Aroostook County Federal Savings and Loan, Fort Fairfield Rotary Club and the McCartney household made unsolicited \$500 contributions, which helped cover minor expenses as they were encountered. Other



A truck on Route 1 approaches Earth and its moon near Percy's Auto Sales in Presque Isle.

donations brought the total money expended to slightly more than \$2,000.

The model took four years to build. Organization and planning started in the summer of 1999 and continued into the early fall, when construction began. The inner four planets, Mercury to Mars, plus Earth's moon were placed on their sites by the end of the first year of work. Jupiter was erected at the end of the second and Saturn at the end of the third year. Neptune was erected in the spring of 2003, with Uranus finished shortly before the official unveiling.

The formal unveiling ceremony was held at the Saturn site on June 8, 2003. Speakers included then UMPI President Nancy Hensel, Senator Susan Collins, Planetary Society President Wesley Huntress, Astronaut Lt. Colonel Rex Walheim, solar system model enthusiast Dr. Bill Brewer, Professor of Psychology, University of Illinois. The ceremony included the launching of a model rocket by Tom Cote.

Further work on the planet sites has been done by a variety of volunteer organizations. Mercury was placed into an already existing garden, which is maintained by Burrell's Press Clipping Service. Gardens for Venus and Earth have been maintained by Tammy Nadeau and her 4-H troop since the original planting of those planets in 2000. The Presque Isle Regional Technology Center helped create gardens at Jupiter and Saturn, which are now maintained by the Central Aroostook ARC (Jupiter) and the Mars Hill Rotary (Saturn). Highly attractive sustained garden work has been done by private citizens in the Bridgewater area at the Uranus site.

The model brought publicity to the County. Magazines that

published articles during or shortly after the construction included *Air and Space*, *Smithsonian*, *Seed*, *enRoute* (inflight magazine for Air Canada) and *New England Journey*. An Associated Press article ran in many newspapers across the country. Newspapers such as *The Boston Globe*, have published features on the model and it has also been the subject of Internet discussions and featured on web pages

including CNN.com. It received a 2006 award from the Maine Tourism Association and many of the planets are now sites for letterboxing (see www.letterboxing.org).

The project has inspired two federal science education grants awarded to the Northern Maine Museum of Science. The museum is now an educational outreach participant in the New Horizons program, which in January 2006 launched a space



Tammy Nadeau's 4-H troop continues to maintain the gardens for Earth (shown here) and Venus, both located in Presque Isle.

UNKNOWN PHOTOGRAPHER



Placing Jupiter on its post between Presque Isle and Westfield.

probe that will reach Pluto in July 2015. The museum also received Maine's first NASA IDEAS grant to develop educational traveling trunks that will support the Maine Solar System Model.

But what about Pluto?

In August, 2006, the International Astronomical Union (IAU) meeting in Prague established a new category for "dwarf planets" and placed Pluto in this group. The decision to reduce the number of classic planets to eight was difficult and remains controversial, but the number of Pluto-like bodies discovered in recent years meant that either there would be eight planets or dozens, depending on how "planet" was defined. This decision formalizes what has long been understood about Pluto: its small size and more elliptical orbit out of the general plane

in which the other planets revolve around the sun makes it much different from the other planets.

Thus far, three bodies have been formally designated as dwarf planets. These are Ceres, in the asteroid belt, Pluto and UB-313. The last of these was commonly nicknamed "Xena" before recently receiving the formal name of "Eris." It is about the same size as Pluto but presently more than twice Pluto's distance from the Sun. More than 20 similar objects have been discovered in recent years, so the number of bodies

formally recognized as dwarf planets surely will increase in the coming years.

The community that built the Maine Solar System Model is now working to add Ceres, Eris and a second Pluto to the solar system model. The dwarf planets will be located along U.S. Route 1 at their current distance from the Sun, rather than their average distance. The current Pluto model at the Houlton Information Center is located at 40 AU, which is Pluto's average distance from the Sun. However, Pluto is presently on the sunward side of its elliptical orbit, at 33 AU. It will still be at about this distance when New Horizons visits Pluto in 2015. Pluto, thus, will have two models in the system, a new model located at the entrance to the Southern Aroostook Agricultural Museum for the dwarf planet and the old

model remaining at the Houlton Information Center.

So planet-building (well, dwarf planet building) in northern Maine begins. The posts for the dwarf planets will be built by the welding program at Northern Maine Community College, and the concrete bases by the masonry program at Loring Job Corps. Parts are being constructed for the recently formalized three dwarfs, and for three more monuments as new bodies are recognized by the IAU. The Maine Solar System Model will only include roadside models larger in scale than a marble, although smaller objects may be displayed indoors at schools, planetaria or information centers such as at Houlton.

It is quite likely that the Maine Solar System Model will ultimately have models throughout the state of Maine. □

Kevin McCartney is professor of geology at the University of Maine at Presque Isle, and director of the Northern Maine Museum of Science. He lives in Caribou with his wife Kate, proprietor of the Old Iron Inn Bed and Breakfast.

