



View of St. Louis, 1846, by Henry Lewis. Courtesy The St. Louis Art Museum

Gateway to the West

Here, near Gateway Arch, the Missouri River empties into the Mississippi. That is why young Pierre LaCledé founded the village of St. Louis here in 1764. He intended it to be a trading center, and the Missouri water highway was vital to any plan to tap the wealth of the West. His judgment proved sound.

In 1803 Lewis and Clark outfitted here for their epic exploration of the Louisiana Purchase. Three years later they returned, and reported that the western part of the continent was a fabulous land, thick with beaver. Soon St. Louis became fur trader to the world, and the pleasant park where the arch now stands was an exotic and busy place. In candle-lit shops and taverns,

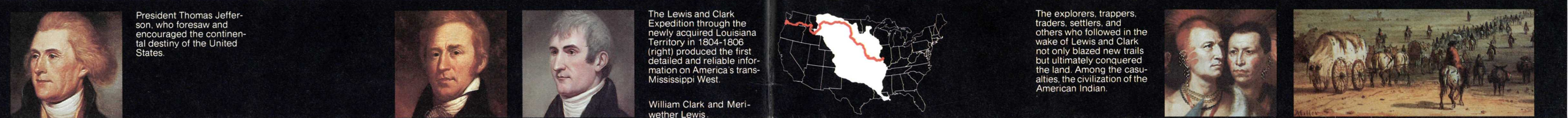
rough-looking men spoke names from the geography of fantasy as though they'd just gotten back—for they had: Santa Fe . . . Great Salt Lake . . . Absaroka . . . Yellowstone. Their furs piled up in warehouses along the waterfront, and on hot days even a stranger could guess the city's main business. The boom lasted until about 1840, when prices fell. But a different, even greater period was just around the corner.

The new boom was westward emigration. The fur trappers' stories had whetted the appetites of land-hungry settlers in the East and even in Europe. At the same time the steamboat came into its own, and the river's importance multiplied. The old wharf at the foot of

the Arch, where four boats tie up now, saw scenes of confusion that sometimes bordered on chaos. Pioneers, merchants, ne'er-do-wells, immigrants, all came in on steamboats that sometimes moored to other steamboats since the whole wharf was full. (This is the period of Henry Lewis' painting above.) They outfitted here and headed west, to Oregon's land or California's gold. The city grew as merchants sprang up to supply the pioneers' needs. Occasionally disaster struck. In 1849 a fire burned the whole downtown area (approximately the present park), and this was followed by a murderous cholera epidemic. But the presence of the cathedral (the spire by the tree in the painting) and the courthouse (shown here with its original smaller dome) indicates that

St. Louis was no longer just a frontier settlement, but the commercial crossroads of the West.

In 1874 Eads Bridge was finished and the railroad era began; steamboats gradually became fewer and fewer. Then in 1890, the U.S. census said there was no more frontier. Today the waterfront is a quiet grassy park. But St. Louis—and the Nation—have not forgotten this city's past. The courthouse—affectionately called "the Old Courthouse" now—is preserved in the park and visitors tour it daily; the Old Cathedral still is open for visitors of all faiths; traffic still rumbles across Eads Bridge; and over it all towers the stunning Gateway Arch. This is a place for remembering.



President Thomas Jefferson, who foresaw and encouraged the continental destiny of the United States.

The Lewis and Clark Expedition through the newly acquired Louisiana Territory in 1804-1806 (right) produced the first detailed and reliable information on America's trans-Mississippi West.

William Clark and Meriwether Lewis.

The explorers, trappers, traders, settlers, and others who followed in the wake of Lewis and Clark not only blazed new trails but ultimately conquered the land. Among the casualties, the civilization of the American Indian.

Exploring the West

In 1800 the United States stretched from the Atlantic to the Mississippi—and stopped. An impartial observer would have seen little chance of the young, struggling country ever reaching the Pacific. But President Thomas Jefferson was not an impartial observer. He sought at least free navigation of the Mississippi for the young country, and possibly he was thinking beyond that as well. But France claimed most of the other side, and Napoleon appeared to be contemplating a New World empire. Napoleon's problems were real: he faced yellow fever, distance, and British seapower; and Jefferson made sure Napoleon knew the vigor and determination of the American people. Napoleon, needing money for European adventures, chose to sell Louisiana to the United States. Without a shot, the Louisiana Purchase doubled the size of the Nation.

But what had Jefferson bought? He sent the Lewis and Clark Expedition to find out, and it left St. Louis in the spring of 1804. Pushing against the Missouri's muddy current was hard, and the hot, mosquito-infested summer was a good introduction to western travel. Lewis and Clark spent the first winter at an Indian village in North Dakota. There they were joined by a young

Indian girl, Sacagawea, who was to be a definite help on the journey, though not the indispensable guide that later myths made her.

Spring 1805: they began again, up the Missouri. There were "firsts" almost daily: the first grizzly to be scientifically described, the first pronghorn, the first mountain sheep. Wool gave way to buckskin; equipment wore out and was replaced with wilderness substitutes. The Missouri became a mountain stream, then gave out altogether. They purchased horses from the Indians. (Often the expedition depended upon Indians, for shelter, food, guidance, and transportation.) Also there was diplomacy, as they informed the Indians of the new United States sovereignty.

Now they were crossing the Rockies. What had been blank spaces on maps in St. Louis turned into great cliffs, tangled timber, and rushing rivers. The two-week forcing of the Bitterroot Mountains, in snow, was the worst hardship of the whole journey. But they made it. They reached the Clearwater River and followed it to the Columbia, which finally led them to the Pacific. Americans had crossed the continent.

The government continued to sponsor exploration of the West. Lt. Zebulon Pike and Maj. Stephen Long both led long treks across the Great Plains and into the eastern Rockies. (They revealed much, but unfortunately they also declared the plains "The Great American Desert," a tremendous misconception that took decades to correct.) Lt. J. C. Fremont's reports of his western travels were accurate, readable and widely distributed. Other government explorers filled in "the areas between" by solid scientific discovery and description, revealing not only paths across the West but what was there as well.

Private citizens filtered west too. There was profit to be made in furs, and soon valleys remote even to Indians beheld an astonishing sight: a figure on a horse, loaded Hawken at hand, slowly pushing up yet another stream. This was the legendary mountain man. His was a precarious existence. There were a dozen ways he could die each day, by cold or heat or thirst, by grizzly or rattlesnake, by falling or drowning or accidental gunshot. Indians too were beginning to recognize the threat to their homeland, and began a long and bitter resistance that they were destined to lose.

Each summer a supply-laden pack train made the long, dangerous trek from St. Louis to some agreed-upon "rendezvous" in the mountains, and mountain men gathered from everywhere. They had been living far from their fellows for a year, in constant danger and testing, and now they let loose for a two-week blowout. They drank, gambled, raced horses, fought, and engaged in a legendary talent for exaggerating stories that didn't need it; even unembellished their experiences were extraordinary. Mixed in with all of this was an exchange of geographic information among men who'd "been there." Somehow the trading finally got done, and by a remarkable coincidence it seemed that whatever the number of pelts a man had, they just about equalled the cost of supplies needed for the next year. The pack train returned to St. Louis and the mountain men went back to the high places, to trap again, to spend the long winter holed-up in some valley, perhaps with a temporarily friendly Indian band, and to wait for the next rendezvous. But around 1840 the rendezvous just weren't the same. Overtrapping and falling fur prices signalled the end of the mountain man era. There had been a hard freedom that in some places—like the Museum of Western Expansion—we can appreciate, but never duplicate.



The Museum of Westward Expansion, located beneath the Memorial Arch, contains exhibits, films, and artifacts (like those shown here) to help visitors understand what it was like to go west in the 19th century.

Objects are not labeled in this museum, for this is a museum of people, not of things. Ideas are expressed by the words of those who were there. The museum tells their story and, in a broader sense, ours as a nation.

Settling the West

By 1840 the West was no longer totally unknown. The fur trade had revealed the basic river systems, basins, and mountain ranges. The Santa Fe trade was well established, and trade with the western Indians was a generation old. But St. Louis was still, as it had been in 1800, the "jumping off place," where settlement ended and the West began.

The expansion of settlement thus far in the country's history had been rapid and steady. From the Atlantic seaboard the settlers had planted farm after farm, always westward. The pattern was "leap-frog," as each settler went just beyond the furthest farm to establish his own on virgin land, and the individual farm was the basic increment of advance. But at the vast, unfamiliar, treeless plains the process stalled. The Nation's expansion paused, waiting for the proper moment to begin again.

The moment came. Economic troubles in the late 1830's coincided with word filtering back from Oregon that acted as a lure. Farmers suffering Northeastern winters heard that Oregon was a farmland utopia, and near the Pacific too, which meant access to world markets. A thousand private decisions, for as many reasons, brought about an unprecedented phenomenon: a people that had spread across half a continent would now make a 2,000-mile leap to the far side of it.

Each spring found St. Louis a busy place, as would-be emigrants outfitted, shared anxious scraps of information and misinformation, and boarded steamboats for Independence, there to form into wagon trains. At a meeting in some muddy pasture—noisy democracy—they elected officers, and one April morning they

headed west. Usually an ex-mountain man led the train, with its cargo of dreams, confusion, and determination.

The first weeks were shake-down. The men learned how to hang a harness at night so it wasn't tangled in the morning, and the proper technique for crossing streams. Women learned to cook unfamiliar foods, using buffalo chips for fuel. And kids, on the greatest adventure of their lives, saw their first lizard and stepped on their first cactus. The family wagon became a familiar place. These were not the great freight-carrying "conestogas" of the Santa Fe Trail, but smaller and lighter.

For many, the trip was the great passage of their lives, with new scenery and a brand new life waiting at the other end; but death and tragedy were common on the trail too. Rarely was the cause Indians. It usually came from an accident with firearms or stock, or ordinary sickness made worse by trail-weariness and unsanitary conditions, or—most dreaded of all—cholera. About 10 percent of those who started never made it.

On the high plains the pioneers wondered at the strange, contorted landscape, so unlike anything they had ever seen before. You can still see it today at places like Scotts Bluff, Chimney Rock, Devil's Gate. Finally a friendly little stream called the Sweetwater led them to South Pass, on the continental divide. They ceremoniously stopped at a small spring on the other side and drank water that, like them, was heading for the Pacific.

They were seasoned travelers now, but a thousand miles had taken its toll and they were weary; yet ahead lay even sterner

tests. They crossed and re-crossed dangerous rivers, and pulled their way between great mountain ranges. Finally the endless journey ended, and they were in Oregon. A few were disappointed, for there had in fact been exaggerations in the reports they had received back east. But it truly was a rich land, and many of the pioneers founded successful farms and communities. It was because of them that Oregon and Washington became part of the United States in a settlement with England in 1846.

In 1848 gold was discovered in California, and in a modern trick of alchemy, gold + mania = GOLD RUSH. The flood of people going west now dwarfed the earlier emigrations. Sometimes it seemed that the line of wagons across the country was almost continuous. As the easy gold played out prospectors fanned out over the mountains, working their way inland, to Nevada and Montana and Colorado. Each strike created a new boom town. Some of these ramshackle towns grew into great cities, while others are ghost towns today. Each of them was another step in the settlement of the West.

The Great Plains, crossed by so many enroute to the West, was the last area to be settled. This was not a failure of drive or desire, but of circumstances and technology. Water was deep underground, communications were slow, distances vast. The first successful exploitation of the prairies was raising cattle. The growing industrial cities of the East needed meat, and soon great herds of longhorns began to supply it. It was the era of the unfenced range; longhorns ranged far and wide, then were rounded up, driven to the nearest railhead, and shipped to market. The drives got shorter and shorter as the railroads

pushed further and further onto the plains. When it became feasible to fence pastures, the day of the open range was over. It had been a fabulous era, one that added the cowboy to the American gallery of heroes. The invention of barbed wire and the cheap, efficient windmill pump meant that now the plains could be both ranched and farmed.

The first to farm the prairies were called "Sodbusters," and no one ever worked harder. The plains were treeless, so they made their houses of sod. Work started before daybreak and never let up; they endured duststorms in August and blizzards in February, locusts all summer, and drought anytime. And their women! What can we say about those women who endured the primitive conditions, the backbreaking toil, the empty loneliness of the prairie farm? They as much as the men were responsible for the checkerboard wheatfields airline passengers see today while flying over the breadbasket of the world.

The century was an astonishing one. Go back merely to 1800, and the Lewis and Clark Expedition had not yet occurred, whole unexpected mountain ranges were behind the mist, the West a blank. A mere 90 years later the Census Bureau reported that there was no longer a definable frontier! The mountain men, the Indians who were displaced, the scared, excited pioneers on the Oregon Trail, the 49ers searching empty rocks for gold, the cowboy on his lonely nightwatch, the even lonelier wife in a sodhouse—all saw their day, and some lived to see it pass and the modern era come in. They should not be forgotten. This place, Jefferson National Expansion Memorial, is a monument to them all.

Gateway Arch

St. Louis
Missouri

National Park Service
U.S. Department of the Interior

Monument to the Dream

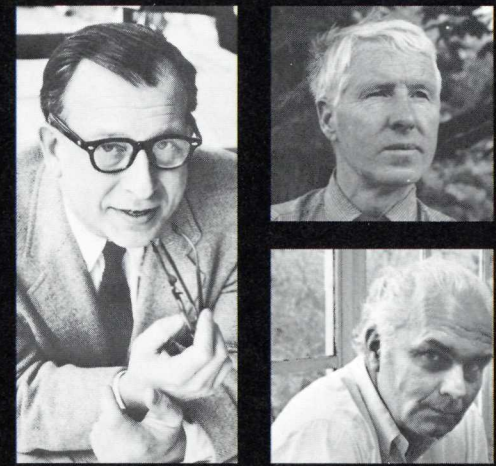
True monuments are timeless. Their grand, simple forms—domes, pyramids, arches, obelisks—are such profound expressions of their time that they transcend time, lasting as long as things last, as permanent architectural truths. This was the thinking of Eero Saarinen, the brilliant Finnish-American architect whose design won the national competition of 1947, when he conceived the heroic arch of stainless steel to celebrate the soaring mind of Jefferson. For the only architect-President was a many-sided genius, who himself created splendid curving forms in the domes of his hilltop home of Monticello and the University of Virginia. Saarinen as a modern architect could not imitate these classical models, as had been done in the Jefferson Memorial of 1937 in Washington, but he did consider a daring contemporary dome, perhaps on the order of Buckminster Fuller's. He discarded the idea because even a dome far larger than the old St. Louis courthouse would not rise up from the levee, in a single spectacular stroke, as a "high form" visible for miles. A great arch would. Furthermore, it would be equally "right" for Jefferson as a classic, enclosing form in space, which would still be superbly open. Only then did Saarinen realize that it could also be seen as a colossal "Gateway to the West."

Few architectural visions have been so powerful and pure. Yet to imagine an arch was very different from constructing a real monument as high as a 60-story building, subject to extreme temperatures, heavy winds, earthquakes, and complex stresses within its gigantic frame. Consequently, the 630-foot Arch that stood magnificently complete in 1965 differed radically from the 590-foot arch shown 17 years before in the breathtaking, but hastily prepared competition drawings. The original design concealed grave flaws within a seemingly ideal curve. If it were not actually unstable, it was perhaps unbuildable, for neither Saarinen nor his engineers (who had not been deeply involved in the competition) yet knew how to make the unique structure stand up, much less precisely how to erect it without staggering cost. By every standard it would be the mightiest freestanding arch ever built, loftier than any symbolic monument except the 984-foot Eiffel Tower, and totally unprecedented esthetically and technically. About a dozen bridge arches are longer, although none is so tall, including the longest of 1652 feet at Bayonne, N.J. Hoover Dam is an arch on its side, 737 feet high and 1292 across. But apart from sheer size, such utilitarian structures have no analogy with Saarinen's spiritual work of art.

Nevertheless spirit was inseparable from science and advanced technology. The role of engineers and other specialists became crucial as the design was studied and restudied during the 1950s and early 1960s, while the project was delayed by lack of funds and other difficulties, because the early scheme—far from being too bold—was hardly audacious enough. Although by the 1940s airplane fusilages and other "shell" structures should have suggested the revolutionary approach that was needed, the architect failed to see the hollow curve as a *continuum*, a single dynamic thing from end to end, like a huge hoop or tube, which was to be the basis of the final design. Instead, he thought of each leg of the Arch as an individual curving structure, bending inward to join its partner. This agreed with Leonardo's theory of an arch as "a strength caused by two weaknesses"; by themselves the sides would tumble, but together they produced a sound form. In a flexible steel structure of this height, however, there would be enormous problems of equilibrium. Even in light winds the Arch would tend to twist and break at its feet, and snap at the top. Risk was increased by a second error, which was merely to use the resplendent stainless steel, potentially very strong in itself, as a non-structural sheathing for the inner frame of carbon steel.

By making the stainless steel a structural "skin," joined with an inner skin in a triangular frame of extraordinary strength, the engineers—notably John Dinkeloo—solved the whole problem. Stability would be assured by concrete poured between the skins, up to 300 feet, forming a "sandwich" drawn taut as a bow by steel "tendons" pulled up from the foundations. It was a structural declaration of independence, which like Jefferson's was much revised before attaining classic eloquence. But Saarinen's imagination was freed. Within the "weighted catenary curve," the shape a hung chain would take if more loaded at the sides than the center, forces would flow logically through the feet of the arch; and the way was open to refine the lithe profile with rational splendor. The Arch was narrowed more finely as it rose in a swift gleaming ascent to the final height of 630 feet, so that the form appears taller than it is wide, although both dimensions are the same. The lines can be drawn mathematically, but in the end the Arch was a poetic conquest of space. All this was nearly done when he died in 1961, at the age of 51, just as construction began. Others would ingeniously erect the Arch, but the vision of national character was now worthy of the Virginian's, in democratic purpose and philosophic truth.

—Allan Temko



Dan Kiley (left) designed the original landscape planting. He covered most of the grounds with trees.

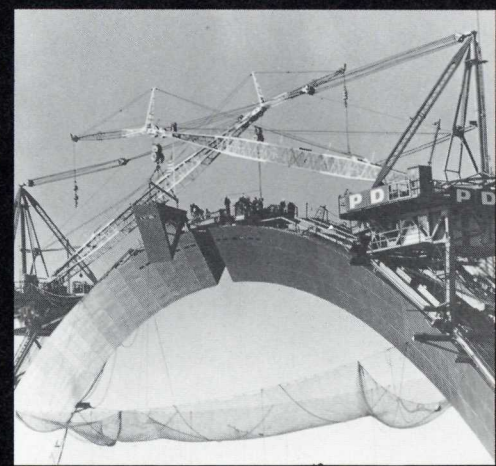
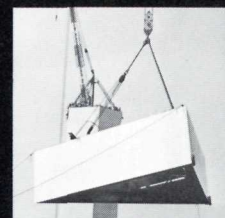
Saarinen's conception for the memorial was by far the most audacious of the 172 entries in the first competition.

John Dinkeloo (above) was in charge of engineering work on the Arch.



In this 1948 competition rendering, the Arch rises elegantly from a forest of trees at the river's edge.

A derrick lifts a triangular section into place.



630 feet

600 feet

In the trees (around the arch) there was... a symbol of the American wilderness into which explorers had forged. The clearing from which the arch would rise, in single magnificence, was the image of the primitive clearings in which they had camped, while the

great Virginian—our only architect President—wished them westward, ever westward, carrying forward the destiny of the nation and the world, and this selfless spirit of discovery, by men for other men, is what the monument should commemorate forever.

Allan Temko, Eero Saarinen

Creepers
Giant ground derricks hoisted the sections into place for the first 72 feet. Above that point, the lifting was done by smaller creepers, which climbed up the backside of each leg.

lowered the stabilizing strut to the ground and were backed slowly down the rails, removing them on the way.

Tracks
Two steel tracks, 24 feet apart, supported the derrick platforms.

Passenger Trams
Two passenger trams, one in each leg, carry visitors to the top of the Arch. Each tram has eight capsules, which hold five persons each. Passengers board the trams in the base of each leg for the 4-minute ride to the top. Electric motors keep the capsules level as they ascend and descend.

Elevators
An enclosed climbing ladder ran from the ground to the derrick platform, but as the legs rose higher, the workers usually rode to the job in a specially built elevator. It ran up one of the derrick's tracks, pulled by cables from a hoist on the ground.

The Arch is designed to withstand any foreseeable natural calamity. Engineers estimate that in a 150 mph wind, the arch will sway only 18 inches at the top.

South Entrance

Geometry of the Arch

The Arch is a pure expression of structural forces. No inner frame or skeleton holds it up. Its stability arises naturally out of a few elegantly simple ideas.

The Arch traces the lines of a "catenary" curve, the shape a weighted chain assumes when freely suspended between two points. This is an exceptionally sound shape for a standing arch. All the forces of thrust are kept continuously in the center of the legs and transferred directly to the foundations.

Foundations

The weight of the Arch is carried by massive concrete foundations sunk deeply into bedrock. The concrete was laid down in four 11-foot courses, laced with net-

works of high-strength steel. To anchor the legs firmly to this base, 1½-inch steel tensioning rods, 252 to a leg, extend into the concrete for varying depths. These "tendons"

are clustered at the corners of each leg and carefully aligned to fit the curve of the first few triangular sections.

The legs of the Arch are equilateral triangles, the most rigid geometrical shape in nature. They taper from 54 feet on a side at ground level to 17 feet at the top. This diminishing taper, aside from its aesthetic merit, greatly reduces wind loading and virtually eliminates stresses caused by oscillations.

The two "skins" of the Arch are load-bearing. They function structurally as the top and bottom flanges of an I-beam in the same way as the stressed skin of an airplane

wing does. The outer skin is ¼-inch polished stainless steel, 886 tons in all. The inner skin is ½-inch carbon steel, increased to 1½ inches at the corners. The space between these two walls is 3 feet wide at ground level, tapering to 7½ inches at the top. Concrete fills this void up to the 300-foot level, weighting the legs and giving the arch great resistance to torsional forces. Reinforcing the concrete is a network of vertical and lateral steel tensioning rods. These rods in the lower half of the Arch and a system of steel stiffeners between the walls in the upper

half help unite the Arch shell into a composite structure of immense strength.

There is a grand clarity to Saarinen's arch, a harnessing of forces to serve the ends of structure and art. Site, purpose, form, and material are fused into one passionate act of homage, linking westerling Americans to our own technological age.

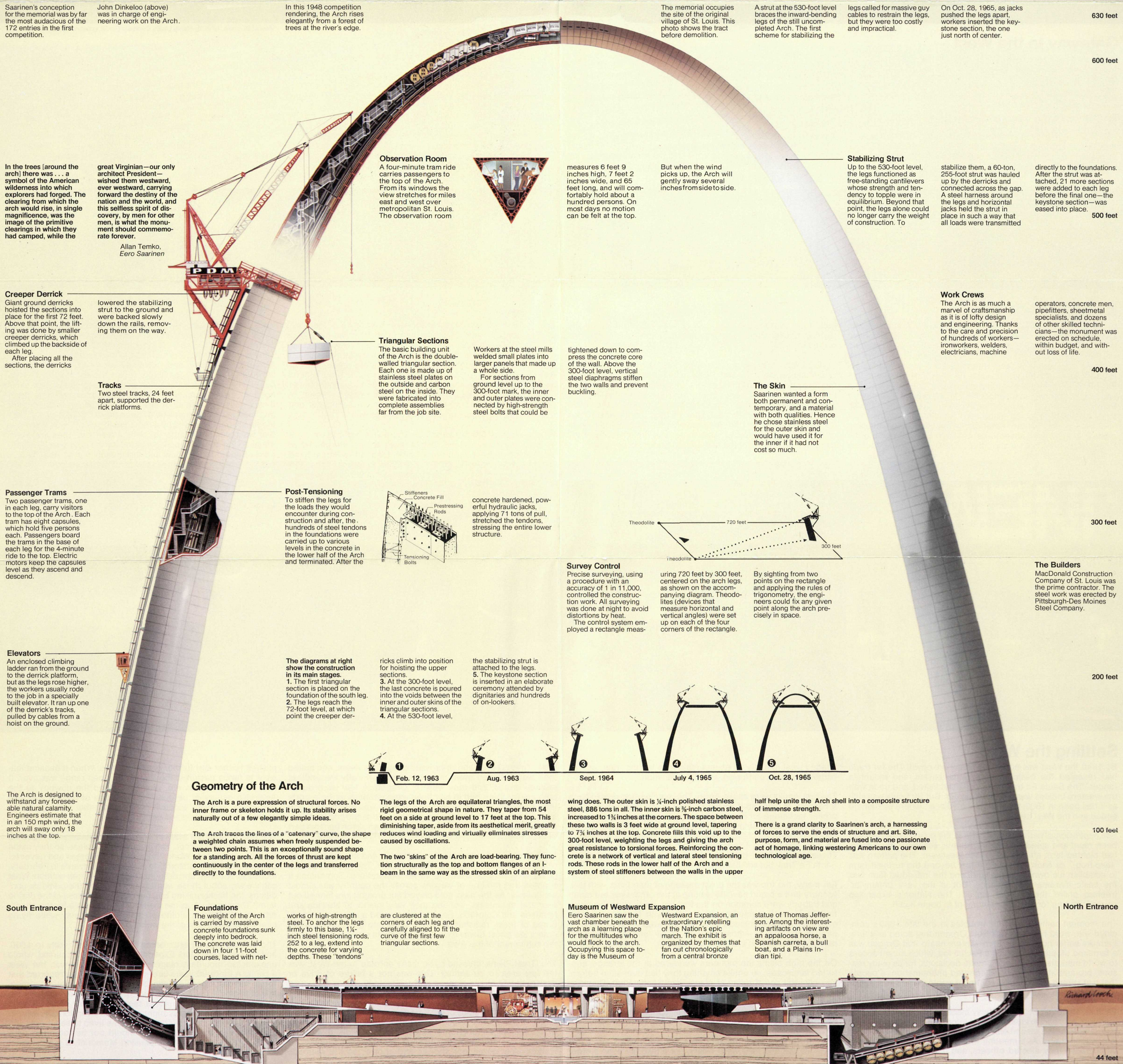
Museum of Westward Expansion

Eero Saarinen saw the vast chamber beneath the arch as a learning place for the multitudes who would flock to the arch. Occupying this space today is the Museum of Westward Expansion, an extraordinary retelling of the Nation's epic march. The exhibit is organized by themes that fan out chronologically from a central bronze

statue of Thomas Jefferson. Among the interesting artifacts on view are an appaloosa horse, a Spanish carreta, a bull boat, and a Plains Indian tipi.

North Entrance

44 feet



Observation Room

A four-minute tram ride carries passengers to the top of the Arch. From its windows the view stretches for miles east and west over metropolitan St. Louis. The observation room

measures 6 feet 9 inches high, 7 feet 2 inches wide, and 65 feet long, and will comfortably hold about a hundred persons. On most days no motion can be felt at the top.

But when the wind picks up, the Arch will gently sway several inches from side to side.

Stabilizing Strut

Up to the 530-foot level, the legs functioned as free-standing cantilevers whose strength and tendency to topple were in equilibrium. Beyond that point, the legs alone could no longer carry the weight of construction. To

stabilize them, a 60-ton, 255-foot strut was hauled up by the derricks and connected across the gap. A steel harness around the legs and horizontal jacks held the strut in place in such a way that all loads were transmitted

directly to the foundations. After the strut was attached, 21 more sections were added to each leg before the final one—the keystone section—was eased into place.

Triangular Sections

The basic building unit of the Arch is the double-walled triangular section. Each one is made up of stainless steel plates on the outside and carbon steel on the inside. They were fabricated into complete assemblies far from the job site.

Workers at the steel mills welded small plates into larger panels that made up a whole side. For sections from ground level up to the 300-foot mark, the inner and outer plates were connected by high-strength steel bolts that could be

tightened down to compress the concrete core of the wall. Above the 300-foot level, vertical steel diaphragms stiffen the two walls and prevent buckling.

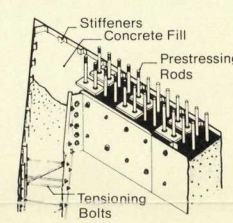
The Skin

Saarinen wanted a form both permanent and contemporary, and a material with both qualities. Hence he chose stainless steel for the outer skin and would have used it for the inner if it had not cost so much.

Work Crews

The Arch is as much a marvel of craftsmanship as it is of lofty design and engineering. Thanks to the care and precision of hundreds of workers—ironworkers, welders, electricians, machine

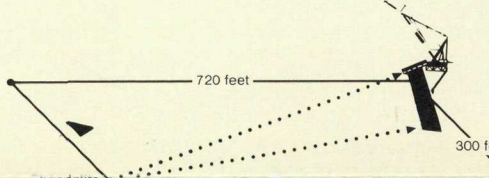
operators, concrete men, pipefitters, sheetmetal specialists, and dozens of other skilled technicians—the monument was erected on schedule, within budget, and without loss of life.



concrete hardened, powerful hydraulic jacks applying 71 tons of pull, stretched the tendons, stressing the entire lower structure.

Survey Control

Precise surveying, using a procedure with an accuracy of 1 in 11,000, controlled the construction work. All surveying was done at night to avoid distortions by heat. The control system employed a rectangle meas-



uring 720 feet by 300 feet, centered on the arch legs, as shown on the accompanying diagram. Theodolites (devices that measure horizontal and vertical angles) were set up on each of the four corners of the rectangle.

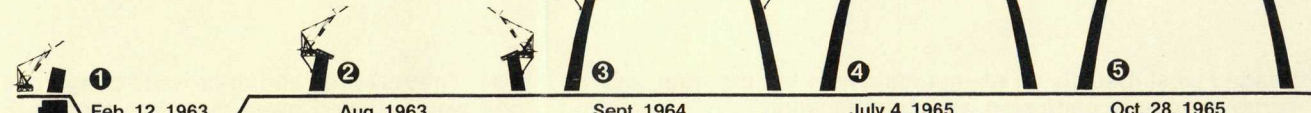
By sighting from two points on the rectangle and applying the rules of trigonometry, the engineers could fix any given point along the arch precisely in space.

The diagrams at right show the construction in its main stages.

1. The first triangular section is placed on the foundation of the south leg.
2. The legs reach the 72-foot level, at which point the creeper derricks climb into position for hoisting the upper sections.
3. At the 300-foot level, the last concrete is poured into the voids between the inner and outer skins of the triangular sections.
4. At the 530-foot level,

the stabilizing strut is attached to the legs.

5. The keystone section is inserted in an elaborate ceremony attended by dignitaries and hundreds of on-lookers.



100 feet