

Dedicated to the increase and diffusion of knowledge about how the nation's lands are apportioned, utilized, and perceived.

# The Lay of the Land

The Center for Land Use Interpretation



"The landscape of the world is a library of human endeavor. How are we to know ourselves if we do not know how to read the land?"  
-Damon Farrugut

## THE NATION'S MEDIA ARCHIVE TAKING OUR PRESENT INTO THE FUTURE



The above-ground conservation building at Culpeper has a terraced, concave wall of windows that curve around a reflecting pool, a shape that evokes the stacked spools of tape and film contained in its underground vaults. CLUI photo

AMONG VARIOUS EFFORTS to preserve the cultural output of western civilization, the Library of Congress' Packard Campus stands out. This facility, partially underground in the Virginia countryside, contains millions of movies, TV episodes, and audio recordings on every conceivable recording format. The process of preserving them in their original form, and digitizing them for the future at the highest quality possible, is taking place at a site whose past is nearly as interesting as its future. This was the former electronic node for America's financial infrastructure, the Federal Reserve Bank's biggest bunker, once known as the Culpeper Switch. It is now the National Audio Visual Conservation Center.

*continued on page 40*

## OLD STEEL

READING THE REMAINS OF AN AMERICAN INDUSTRY



Old Steel was the subject of an exhibit at the CLUI, shown at the Los Angeles exhibit space from October 2012 through January 2013. CLUI photo

THERE ARE TWO types of steel in the world, Old Steel and New Steel. Old Steel was made with big blast furnaces and batteries of coke ovens, and by moving around vats of molten metal in integrated production plants that covered hundreds of acres. Old Steel transformed raw materials from the earth—iron ore, limestone, and coal—into a new material, hard enough for the bones and viscera of the new, manufactured nation. This began with the railways converting from brittle iron rails to Bessemer steel in Pennsylvania in the 1870s, and the empires of Carnegie, Frick, and Schwab. And it continued through the 1970s, with Republic Steel, Bethlehem Steel, and U.S. Steel, for years among the largest corporations on

*continued on next page*

## Editor's Note

Welcome to the 36th edition of *The Lay of the Land*, the annual newsletter of the Center for Land Use Interpretation. While some previous issues have had a regional structure, reflecting the far-flung field offices and study areas of the CLUI, this issue is arranged thematically, around some of the land use categories and program areas explored by the Center. These thematic headings are created to help us organize the infinity of information about the contemporary landscape of America. They also exist to emphasize what we feel are some of the most curious and compelling issues facing us today, as a nation. We hope you enjoy this newsletter, which we convey with continued amazement at the ways that we, collectively, engrave our inscription on the ground, by intent or incident, with awareness and without. Above all, we are grateful for you, dear reader, for coming with us on this journey of observation, discovery, and realization. Thanks for *being there!*

## IN THIS ISSUE

THE NATION'S MEDIA ARCHIVE.....	1
OLD STEEL.....	1
INITIAL POINTS OF AMERICA.....	5
SITE REPORT: FOUR CORNERS.....	7
THEMATIC FOCUS: LAND ART.....	10
THEMATIC FOCUS: AEROSPACE.....	17
THEMATIC FOCUS: RADIOACTIVE SITES.....	23
NEW JERSEY'S MEADOWLANDS.....	28
CLUI ACTIVITIES.....	37
BOOK REVIEWS .....	43

## OLD STEEL

*continued from page one*

earth. Then, at some point, there was enough steel in the world, and steel began to eat itself up.

New Steel, as the steel of today is called, is made from ground-up scrap, the very railways, warships, buildings, cars, appliances, and office furniture made by Old Steel, re-melted in electric arc furnaces, and drained into continuous casting machines. Even the old steel plants themselves are cut up and melted down in the vats of New Steel. Today, steel is the most recycled industrial material (besides, perhaps, concrete). More than 90% of the steel produced in the USA comes from scrap made in the USA. There are around 120 mini-mills in the country, most built after the early 1980s, which produce the majority of the domestic steel we consume, and all of which make steel from 100% scrap.

Then there are the remaining Old Steel sites, around twenty still producing at least some steel the old way. Even here, in these lingering mega-mills from the last century, they fill their blast furnaces with 75% scrap, or more. And though they are going away, it seems, one by one, their physical legacy is vast, and lasting.

These sites are the largest industrial landscapes in the nation, and most of them have been at work at the same location for more than a century, long before industrial contamination was considered or environmental laws existed. These active and former Old Steel plants are places from another time, but they are here, amongst us, now, and in some ways, forever.

Despite the historic impact of Old Steel on the landscape, economy, and people of the nation, only a few efforts exist to preserve and interpret them. This is a great loss, as their scale, drama, and hubris might be hard to believe in the future.

The CLUI presented *Old Steel* for three months at its space in Los Angeles, starting October 12, 2012. The exhibit described the arc of the history of American steel, using text and hundreds of images of steel sites around the nation, taken by photographers from the CLUI mostly over the last year. It was a survey of the physical state of the industry at this moment, focusing on the large old production centers, what most people imagine when they think of steel mills, and what we call Old Steel. Researchers visited industry archives, met with retirees, historians, and local museum representatives, and visited more than a hundred former and current steel sites. Photographs were taken from the ground, and from the air.

The CLUI exhibit was divided into chapters that followed Old Steel geographically, starting from the early mills of Pittsburgh, where the site of the old Homestead Works is now a shopping center, and where U.S. Steel still presides over their remains of the industry. The exhibit traversed the national terrain, through the gone sites of Youngstown and Buffalo, to the still active barrage of mills along the Indiana shore of Lake Michigan. It ended in eastern Pennsylvania, the land of Bethlehem Steel, whose flagship plant is now owned by a casino, and awaiting museumification.

## AN OVERVIEW OF THE MAJOR STEEL PRODUCING REGIONS

### Pittsburgh: Epicenter of Old Steel

Pittsburgh is where Andrew Carnegie's empire was based, and where, around 1900, nearly half of the nation's steel was produced. Pittsburgh was at the crossroads of the natural resources needed for steel—iron, coal, and limestone, all extracted in abundance from the area—and there were rivers and railroads to move things around. Today, Pittsburgh is still the headquarters of the U.S. Steel Corporation, the last large old American steel company, and the region still produces nearly five million tons of steel a year, more than half of it by U.S. Steel's Edgar Thompson Plant, in Braddock, a functioning relic of Old Steel.



A few miles up the Monongahela River from downtown Pittsburgh is U.S. Steel's Edgar Thompson steel plant. The first steel works here were built in 1875, to produce rails for the Pennsylvania Railroad. This was Andrew Carnegie's first large steel mill purchase, the beginning of his steel empire. It is still a major producer, and employs around 1,000 people. The plant makes 2.8 million tons of steel annually, the largest remaining producer in the Pittsburgh region. It is part of U.S. Steel's Mon Valley Works, a network that includes the Clairton Coke Works and the nearby Irvin finishing plant. CLUI photo

### Northeast Ohio: Cleveland and Youngstown

Historically, Ohio is the second most productive steel state, after Pennsylvania. Today, it is the second most productive steel state, after Indiana. Old Steel is clustered in the northeast, along the Cuyahoga River in Cleveland, and in the Mahoning Valley around Youngstown, which produced more steel than any other part of Ohio. Eventually the Mahoning Valley became comparatively logistically isolated, losing out to the rail and river access at nearby Pittsburgh and the iron and limestone ports along the shores of the Great Lakes (a proposed canal leading to Youngstown was never built). Youngstown was among the first of the Old Steel regions to fall.



The Cleveland Works is an assemblage of facilities along the Cuyahoga River south of Cleveland, now owned by ArcelorMittal, and still producing up to four million tons of raw steel per year. Nearby, in Lorain and Youngstown, some of the Old Steel plants are actually expanding to produce pipe for the gas industry. CLUI photo



## Upper Ohio River

On the Ohio River, Old Steel was concentrated on its northern end, between Pittsburgh and Wheeling, West Virginia, a stretch of less than 100 river miles, with the densest stretch in the eight miles from Weirton, West Virginia, to Mingo Junction, Ohio. Along here are some of the most dramatic remains of the industry, for years teetering on the edge of production, in dramatic industrial townscapes packed into tight valleys, steel towns depicted in the classic American film *The Deer Hunter*. This region is on the verge of transformation—three of the main steel plants are now closed, and in new hands, with plans to demolish them.



The Weirton Steel Works, in West Virginia, was founded in 1909, and was one of the largest producers of tin plate in the nation, with 12,000 employees at its peak. It ceased making new steel in 2007, and it is shut down and for sale. Across the Ohio River, the plants at Mingo Junction and Steubenville were both bought by scrapers in 2012. CLUI photo

## Birmingham: Southern Steel

The iron and steel industry started in Birmingham during the Civil War, after the region's local resources of iron, coal, and limestone were discovered and exploited to produce weapons for the Confederate army. Later, spurred on by demand for steel for World War I and II, 26,400 people worked in steel-related industries in the four counties around Birmingham by 1970. By the mid-1980s, with the collapse of American steel, employment in the industry fell to just over 10,000. Today Birmingham is still a major iron and steel products center, though mostly making pipes, valves, and fittings.



Close to downtown Birmingham, the Sloss Furnaces are the only blast furnaces in the nation that are fully (and officially) open to the public. Visitors are permitted to wander all over on their own, and creative public events are held at the site, including a popular annual Halloween haunted house. CLUI photo

## The West

Old Steel, which generally precedes World War II, hardly exists in the west. One exception is the relatively small Seattle Steel Company, which was established in west Seattle in 1905, a site which now has a Nucor Steel mini-mill on it, with the rest of

the site redeveloped into housing and port facilities. Another exception, and the only large-scale Old Steel site in the west, is the Rocky Mountain Steel works in Pueblo, Colorado, which is still producing and occupying its original footprint. A few large integrated steelworks were made during World War II to provide steel for the shipyards that were built hurriedly in every major city on the west coast. Most of these plants were built inland, to be out of range of enemy ships and submarines. Though largely closed and demolished, the former Kaiser Steel plant in Fontana, California, still has some steel finishing activities at the site, and a large finishing plant in Pittsburg, California, which dates back to 1906, is now operated by U.S. Steel and a Korean steel company, though no new steel is made there either.



Rocky Mountain Steel, in Pueblo, Colorado, opened in 1882, the first integrated steel mill built west of the Mississippi River. It was operated mostly by Colorado Fuel and Iron Company (CF&I), which was bankrolled by Rockefeller and Gould. It remains the largest functioning Old Steel site in the west, though it no longer makes new steel—it melts down steel scrap to make wire, fencing, and pipe. Today the plant is owned by Evraz, a Russian mining and steel company. CLUI photo

## Detroit: Automotive Steel

Cars are a major consumer of steel, and Michigan is the largest producer of the 15 million automobiles made in the USA every year. Henry Ford, one of the main proponents of the concept of integrated production methods, placed steel plants into his automobile plant at River Rouge in 1917. Two other Old Steel plants around Detroit are nearby, along the Detroit River. One is defunct, the other still producing. These two operating steel plants together produce almost seven million tons of new steel a year, making the south side of Detroit the second largest localized steel production area in the nation.



The River Rouge plant of the Ford Motor Company was the most vertically integrated large-scale manufacturing plant in the nation. Raw material came by barge to its port, and finished automobiles drove out the door. 100,000 people worked there at its peak. Today the steel plant is operated separately from Ford by the Russian company Severstal Steel, and Ford makes F-150 pickup trucks at a new plant next door. CLUI photo



### The Lake Shore: Still There in a Big Way

This region, along the Indiana shore of Lake Michigan, east of Chicago, is the largest heavy industry area in the USA, and one of the most productive steel regions in the world. Three large plants dominate the area. The two on either end are currently owned by ArcelorMittal, the largest steel company in the world, with 260,000 employees worldwide. Based in Luxembourg, ArcelorMittal is the product of the consolidation of many American and international steel companies, including U.S. Inland Steel and ISG, former owners of these Lake Shore plants. The company produces 100 million tons of steel per year from its operations around the world, 35% of it in the USA, and 15% of it here, on the Lake Shore. In the middle, between the ArcelorMittal plants at Indiana Harbor and Burns Harbor, is the U.S. Steel plant at Gary. Built more than 100 years ago by U.S. Steel, this is the largest plant for the nation's largest remaining domestic steel company. These three plants together produce more than 22 million tons of steel a year, 30% of the total produced nationwide.



The Gary Works of U.S. Steel is the second largest steel works operating in the USA, producing 7.5 million tons of steel per year, employing more than 6,000 people. CLUI photo

### Buffalo: Gone But Not Forgotten

Though other Old Steel plants around the Great Lakes still operate, steel production in Buffalo, New York has run its course from existence to memory. The Pan-American Exposition was held in the city in 1901, while the Lackawanna Steel Company was in the middle of constructing the first plant in Buffalo. This plant would become one of the largest steel plants in the world—it employed 6,000 people when it opened the following year. It closed in the 1980s, and by the end of the century, most of it was demolished and managed as a hazardous waste site. A small museum preserves the legacy of Buffalo's steel heritage.



The Lackawanna Steel Plant was once one of the world's largest, with 20,000 employees in the 1940s. It opened in 1902 and closed in 1982, and is now a landscape of piles of different kinds of post-industrial earth and partially demolished ruins. It officially became a Superfund site in 1988 and an official Brownfield in 2003. CLUI photo

### Eastern Pennsylvania, and Bethlehem Steel

The arc of Bethlehem Steel is the arc of Old Steel in America. It was perennially the second largest steel company, after U.S. Steel, and around 1917, it was the third largest corporate entity in the USA, after U.S. Steel and Standard Oil. The company started with iron making in the 1850s, in the little eastern Pennsylvania town of Bethlehem, where its principal plant grew to immense size.

The company expanded with acquisitions, and eventually had nearly 300,000 employees at its mills and shipyards across the country. In 1973, at its post-war peak, it produced 23.7 million tons of raw steel and employed 150,000. In 1975 Japan surpassed the USA in steel production, and the decline of American steel was underway. By 1982, Bethlehem had 67,000 employees. When it filed for bankruptcy in 2001, its remaining 13,000 employees were laid off, and the home plant in Bethlehem closed.

The hometown plant is now mostly owned by the Sands Corporation of Las Vegas, which opened a popular casino at the plant site in 2009. The company has so far spared some of the blast furnaces and other old buildings from demolition, but others have been torn down. Bethlehem Steel's thirteen-story Art Deco former headquarters building is completely empty, and full of mold.



The National Museum of Industrial History, a Smithsonian affiliate museum, has been proposed for one of the old mill buildings for more than a decade, but is still a ways off from being opened. This museum, and the National Iron and Steel Heritage Museum, based at a former Bethlehem plant in the eastern Pennsylvania town of Coatesville, are the two largest efforts underway to create a national-scaled steel museum in the USA, though both are still only in development. CLUI photo

The former Bethlehem Steel plant at Sparrows Point, located in Baltimore's outer harbor, is the only Old Steel plant on the Atlantic Coast, and is one of the largest and most modern integrated steel plants in the country. It has been closed for a few years. The current owners, Hilco and Environmental Liability Transfer, bought the 3,000 acre site for \$72.5 million in August 2012, four years after the plant sold for \$810 million. The current plan, as of January 2013, is to raze the plant. The Nucor Steel company, which pioneered scrap mini-mills in the USA, will use some of the facilities for parts. The rest will probably be melted down to make New Steel. ♦

View a clickable map of Old Steel sites at [www.clui.org/content/old-steel](http://www.clui.org/content/old-steel)



## THE INITIAL POINTS OF AMERICA

### ANCHORING THE NATIONAL GRID



*Initial Points: Anchors of America's Grid* at CLUI Los Angeles.

CLUI photo

THERE IS AN initial point to the USA. In fact, there are 37 of them. They are the original land anchor points for the first federal surveys that mapped and claimed the nation's lands from its previous owners (the Indians, Spanish, French, Russians, etc). These Initial Points were established by surveyors dispatched into the field, usually soon after treaties and other agreements were signed, to tie the new territory to the Public Land Survey System, the rectilinear grid that covers more than two-thirds of the landscape of the USA, as mandated by the Continental Congress of 1785.

Each survey of new federal land had to begin from a single, precisely measured starting point. In 1785 the initial Initial Point was established, and it took more than a century for the process to play out. Finally, by 1881, the last of 32 Initial Points in the contiguous continental United States was set. Between 1905 and 1956, the final five in Alaska were completed, bringing the total to 37.

Starting in 2010, working with the Institute of Marking and Measuring, the CLUI began putting together an exhibit about these Initial Points as they look today, believing that it would reveal much about the often arcane process of surveying, as well as provide a new kind of historical portrait of the American land. The exhibit opened at the Center's Los Angeles display space in late 2011, and was shown until February, 2012, after which it traveled to the National Museum of Surveying, in Springfield, Illinois.

These surveying points, located in places such as swamps, under manhole covers in roads, and on top of mountains, are the physical locations that tied the conceptual grid to the ground. Though many of them were made obsolete by subsequent surveys, they all remain as important and generally overlooked historic sites. Looking at them in a contemporary context explores the process and importance of the endeavor of surveying, and reveals a latent cadastral history of the nation, as it expanded westward.

## A LOOK AT THREE OF THE 37 INITIAL POINTS OF THE USA



CLUI photo

### The Point of Beginning

The measuring of most of America began in Ohio in 1785, at a surveyed marker called the Point of Beginning, where Ohio, Pennsylvania, and West Virginia meet. Marking the Initial Point began when state surveyors from Pennsylvania and Virginia agreed on where the north/south line dividing their states met Ohio's boundary, on the north shore of the Ohio River. The stake they drove into the ground that day in 1785 has long since washed away, and the land is now owned by an industrial supplies company. A stone monument commemorating the survey point has existed nearby, where the state line meets a public road, since at least 1881. The current monument was installed in 1960, and is 1,112 feet north of the original Point of Beginning—the initial Initial Point, that marked the edge of the land claimed by the 13 original colonies, and the beginning of “The West.”



CLUI photo

### Tallahassee Meridian

The treaty made with the Spanish, transferring the ownership of Florida to the USA, was ratified in 1821, and in 1824 the federal government undertook the surveying program to legally measure and describe the land of the state. The Initial Point was selected to be at the newly-established seat of government, in what is now the state's capitol city, Tallahassee. A site one-quarter mile east and one-quarter mile south from the future State Capitol building was selected to start the survey, and a wooden stake was set in the swampy ground. Lots in town went on the market a month later, and the American development of Florida began. Today, the Initial Point is in a park next to state offices on Meridian Road. The current monument was built in 1925 on top of a monument from 1892. The 1892 monument consisted of a one-ton boulder,



hauled on a wagon from 20 miles away, and placed into a hole in the ground. The cardinal points (north, east, south, and west) were indicated with a cross carved into the stone, with the township and range numbers in the spaces between the lines. Research suggests that the monument constructed in 1892 (and thus the current one) is actually ten feet east of the original 1824 Initial Point location.



CLUI photo

## The Sixth Principal Meridian

Within an area mostly acquired as part of the Louisiana Purchase, the Sixth Principal Meridian is a north/south line established in 1855 in order to survey the newly created territories of Nebraska and Kansas. Surveyors started where the 40th degree of latitude met the Missouri River, and headed west to establish the baseline. After 108 miles they stopped, as instructed by the Commissioner of the General Land Office, due to “apprehensions of hostile interruptions from the Indians.” So the Initial Point was set there, and the meridian established north and south. The baseline was eventually extended west, and became the state line between Nebraska and Kansas.

By modern times, the Initial Point had been heavily monumented, most recently in 1986 and 1987 by a group known as the Professional Surveyors of the Sixth Principal Meridian, consisting of surveyors from the states affected directly by the meridian. Canted plaques mention the names of a few hundred surveyors singled out for distinctive recognition, and describe the history of the site. A central monument features a pentagonal spire, each facet engraved with the name and seal of one of the five states surveyed mostly or partly from this point: Kansas, Nebraska, Colorado, Wyoming, and South Dakota.

The original surveyor’s stone, which had been broken and buried for many years, was rediscovered in 1986. It was reburied at the exact location of the original Initial Point, 66 feet west of the interpretive monuments. A 24-foot square concrete pad was poured around the stone, which was left accessible through a cavity in the middle of the pad, accessed by a manhole cover. Underneath the commemorative manhole cover, a couple of feet down, is the original red sandstone surveyor’s rock from 1856, now embedded with a BLM surveying disc. ♦

View a clickable map of Initial Points at [www.clui.org/page/initial-points-map](http://www.clui.org/page/initial-points-map)



On a visit with Social Practice students at Portland State University earlier this year, CLUI Director Matthew Coolidge took the class to the Willamette Stone, the Initial Point of Oregon, from which most of the Pacific Northwest was surveyed. There the class met Tim Kent, a professional land surveyor and former professor of Geomatics at the Oregon Institute of Technology, to discuss the significance of the site and the processes of early surveyors. Members of the class hiked due north, into the woods, taking stakes and the end of a Gunter Chain, just as the early surveyors did when measuring the first 66 feet into the new Territory in 1851. Over the years since then, the stone used to mark the survey point has suffered a dramatic history of sporadic vandalism. (see [www.clui.org/section/willamette-meridian](http://www.clui.org/section/willamette-meridian)). CLUI photo

## INITIAL POINTS SURVEY FIELD SESSION

GROUP ANCHORS CLUI TO THE GRID



Jesse Vogler of IMAM and the group at the Baldwin Hills Overlook. CLUI photo

AS PART OF the opening of the exhibit *Initial Points: Anchors of America’s Grid*, Jesse Vogler and Louis Schalk from the Institute of Marking and Measuring (IMAM) led a public field session and surveying exercise in the urban landscape of Los Angeles. The group, a few dozen members of the public who responded to an email announcement, gathered at the CLUI for a brief run-through of the exhibit and an overview of the day’s activities.

The group then headed out the front door of the CLUI, where a five-inch-deep hole had been drilled in the curb a half hour earlier. The base of a brass monument was inserted in the hole, in front of the crowd, and epoxied in place. The brass monument, supplied and inscribed by the City of Los Angeles, was to become part of the city’s official network of more than 17,000 benchmarks covering a 1,700 square mile area, each indicating their elevation relative to a



## LINESCAPE

fixed starting point plane known as the National Geodetic Datum of 1929, based on sea level, as determined originally in 1929.

The group then moved one block west, to the nearest existing benchmark (number 13-02781), embedded in the curb at the corner of Cardiff Street and Venice Boulevard, next to an Indian boutique. While one member of the Institute of Marking and Measuring team held a surveyor's rod (a telescoping graduated pole showing inches and feet, like a tall ruler) over the benchmark, another member set up an optical level on a tripod at a point due west of the new CLUI marker, one block away.



The total station, seen here atop the Baldwin Hills, is the primary tool of the modern surveyor. It combines the function of a level, transit, theodolite, and an electronic distance measuring (EDM) device. CLUI photo

With this device, a level elevation plane could be established a few feet above the ground, by looking at the rod through the level. This plane was then transferred down the block (in a number of steps, around objects restricting the view) to the new CLUI benchmark, enabling its elevation to be calculated relative to the existing one.

The Cardiff Street benchmark was at a known elevation of 103.103 feet above sea level. The new benchmark was calculated to be at 104.713 feet above sea level, 1.61 feet higher than the point to the west, suggesting a slight downward slope westward, to the ocean a few miles away (note, too, that surveyors use tenths of a foot, not inches, or twelfths.) Once this step was accomplished, the group broke up to re-form at the Baldwin Hills Overlook, a bare hilltop in a nearby park.

This location provides a direct line of sight to the front door of the CLUI, nearly a mile away, and to the new benchmark in the curb. Jesse Vogler of IMAM set up a total station at the top of the mound, and pointed its lens downward. Sarah Simons, of the CLUI, was outside the door holding a rod with a prism attached to it.

The total station's electronic measuring system emits an infrared signal that bounces off the prism and back to the total station, enabling the device to immediately calculate the distance between them: 4,954.33 feet. With this figure known, the elevation of the top of the hill is determined by calculating the angle of the total station's scope, looking at the prism (the difference between the optical plane of the device and the prism), an amount calculated by the device to be 324.06 feet. From this we add the elevation of the benchmark (which we determined earlier to be 104.713 feet above

sea level), add the height of the prism above the benchmark (6.00 feet, as indicated on its graduated pole), and subtract the distance of the total station's focal plane to the ground (measured by the device's infrared signal to be 4.94 feet), and arrive at the number 429.833 feet: the height of the hill we are standing on, above sea level.

Also visible from this point atop the Baldwin Hills Overlook, especially on a clear day such as this, is San Bernardino Peak, a mountain 85 miles to the east, which was used as the original survey point for the federal survey for all of Southern California. Using the peak as the zero angle, the total station determines the CLUI is 222.33.0 degrees relative to it, and using the overlook as a fulcrum, it was thus possible for us to connect the CLUI benchmark to this Initial Point of the public land survey—the rectilinear matrix of the west, and the subject of the exhibit *Initial Points: Anchors of America's Grid*, in the building 4,954.33 feet away in the grid below. ♦

### FOUR CORNERS MONUMENT

A LOCATIONAL AWARENESS ARENA



The new cartographic tourist arena at the Four Corners Monument. CLUI photo

THE FOUR CORNERS monument is an unusual cartographic landmark, and it keeps getting bigger and better. The latest version opened to the public in 2010, significantly expanded to accommodate the activity that people engage in there, a particular form of ground truthing, geographic performance, and souvenir photography. The early monuments were simple pads with lines. Now it is an arena, where spectators can sit and watch while people perform their cadastral contortions at the convergence point.

Most linear attractions in the nation are binary, like a state line marked on the pavement, creating two different places to be in at once—here, and there—something well suited to a bipedal creature, like humans. Things get a little more complicated at tri-points, where three states come together on land. While this occurs 35 times in the USA, and most of the sites are clearly marked with a monument, they are visited infrequently, as few of them are served by a road.

At Four Corners, of course, *four* states converge at one point, the only place where this occurs in the nation. And though it is far from



most places where people live, for many it requires a pilgrimage, to obtain geo-photographic evidence that you can be in many places at once. From a single point, your body extends cartographically to the limits of four large southwestern states, an area of 424,579 square miles. It is a sensation of being both on and in a map, where you have awareness of your body in relation to the vastness of America. And you are fixed in an exact place, locked down by both axis of the grid. Here you know exactly where you are.



The convergence of the four state lines is infinitely small, so only one person can really be in four states at one time. The circle helps expand the space so the multi-state sensation can be enjoyed by more people simultaneously. CLUI photo

It is unknown if the 19th century surveyors leaving their various marks felt such elations. Ehud Darling was the first federal surveyor to come through, in 1868, when he surveyed the 37th parallel of latitude to establish the boundary between the territories of Colorado and New Mexico. He started at the northeast corner of New Mexico and headed west along the line, leaving marked stones as he went, and stopped at a site that was 8,192 feet west of the current site. Close enough.

Next came Chandler Robbins, in 1875, who surveyed the north/south line dividing New Mexico from Arizona, as established by law in 1863 as being 32 degrees west from the Washington Meridian (which ran through the dome of the Naval Observatory in Washington D.C.) He triangulated from an already surveyed point at Shiprock to determine the longitudinal (north/south) line, and where that line met Darling's east/west line is where Robbins began his survey southward. He set a marked stone there, which was the first Four Corners monument. Three years later the surveyor Rollin J. Reeves started at the monument and marked a line north between Utah and Colorado.

In 1903, Harold Carpenter was commissioned to resurvey this portion of the 37th parallel, which was by then a boundary line that spanned nearly half the continent, the accepted boundary between Utah and Arizona, Colorado and New Mexico, and Kansas and Oklahoma (and was historically significant too as it also marked the division of western slave states and free states up to the Civil War).

Carpenter found that Darling's 1863 attempt to mark the parallel for the 331 miles dividing Colorado and New Mexico, as recorded in his field notes and marked with more than 200 milestones and eleven astronomical monuments, wandered, and was often off by

more than 1/3 of a mile. Carpenter, as instructed, destroyed all of Darling's markers as he went, and established his own. After submitting his report and field notes to the Federal Land Office, his new line was accepted as the correct division between the states. As a result, a narrow strip of land totaling dozens of square miles, most of one town, two villages, and five post offices, were awarded to New Mexico, and taken from Colorado.

Congress approved a resolution changing the state line in 1908, but the President vetoed it. A lawsuit between the states over the matter was decided by the U.S. Supreme Court in 1925, confirming that the original Darling survey from 1868, though in error, was to continue to be used as the official boundary. It was concluded that the 1903 line, though more precise, would also have inaccuracies, and that no survey could be completely accurate.

In 1931, a more significant bronze disc was embedded in the ground with concrete, by Everett Kimmel of the General Land Office, replacing a smaller monument that had been placed there in 1912, when New Mexico became a state, which itself had replaced the Page-Lentz Stone, a surveyors monument placed there in 1899 (named after two U.S. surveyors who were visiting the area at that time and found that the original marker had been broken and moved.)

In 1962 the site was upgraded by the BLM and the Bureau of Indian Affairs with a bigger concrete pad, and embedded radial lines emanating from Kimmel's bronze disc at the center, quartering the pad into four triangular zones of equal size, with a large bronze seal from each state, and the name of each state embedded in the pad with large letters. The words FOUR STATES HERE MEET IN FREEDOM UNDER GOD were also engraved in the concrete in a circle, though often scratched out over the following years. For the next couple of decades, the pad was surrounded by highway guardrails to keep people from driving their cars in four states at once.

In 1992, the site was significantly upgraded again, with a new bronze disc, and by raising the concrete pad, which was rebuilt, with the same features of the 1962 pad, surrounding it with bollards (replacing the guardrail), more flagpoles, and a viewing platform.

In 2010, after periodic closures for construction that frustrated visitors who had come from miles away, the latest version opened to the public, the largest transformation yet. The original brass disc from 1992 remains the epicenter of a reconstruction of the 1992 pad, but with a larger concrete square, 200 feet on each side, surrounding it, and sloping inwards. Rows of benches face the epicenter, and now four ADA-compliant raised viewing platforms, one in each state, provide an elevated view of the monument, and serve as a photographic platform for taking pictures of friends, family, and pets engaged in the contortions and ecstasy of quadrostatism.

Permanent shade structures for vending stalls line the perimeter of the monument area, forming an outer square, looking inwards. From these perches sit local Native Americans watching the performances of the hundreds of visitors the site sees daily, like judges who never hold up a score-card or offer a verdict. ♦

2012 was a big year on Los Angeles' highways. There were two Carmageddon events, when the 405 freeway was closed down for bridge construction for a few days, and the anticipated traffic disaster that didn't happen as a result. But the really big thing was, really, three big things, three of the biggest things ever to travel over the city's roads. Though they each moved in their own way to their own destinations, for their own reasons, and at different times, they all moved superlatively, and slowly, in the dark. Taken together, this non-colliding accident reads like a poem of human endeavor: the Ancient, the Present, and the Hereafter.

These three big things also provided a surprising affirmation of some of the themes we have been working with over the last year (land art, aviation, and radioactivity), which we will explore more in the following pages.

## BIG THINGS ON THE MOVE

### SUPERLOADS ON THE HIGHWAYS OF LOS ANGELES

FIRST CAME THE Rock, sculptor Michael Heizer's 340-ton boulder, selected from a quarry in the Inland Empire, and moved to a sculptural cradle prepared for it in the backyard of the Los Angeles County Museum of Art, 52 miles away, as the crow flies. Though the Rock had been blasted from the earth in 2006, it took years to gather together the financial, social, political, and logistical forces to move it. But in March 2012, the Rock began to roll, as they say.

The trip took several days to cover 105 miles of road, twice the actual distance, in order to zig-zag past overpasses, and keep on streets wide enough that could bear the load. Top speed was seven mph, but it was usually less. In addition to the utility trucks buzzing around it to take down traffic lights and electric lines and then put them back up, there were another dozen or so support staff walking with it, the whole way. It was a bit like a religious procession, with acolytes in hard hats and safety-vest vestments walking alongside the sacred monolith, all lit up and flashing—a sort of mobile *Levitated Mass* mass, bringing the congregation of a random LA cross-section out to the streets in the dark middle of the night to ogle and cheer.

On the 11th day, when the Rock arrived at the museum, a thousand people were there at 4:30 in the morning. Everyone was surprised by the amount of media attention, and how it stayed favorable despite the reported \$10 million cost (paid for by donations, none from the public museum directly), and apparent absurdity, for many, of moving a boulder to a museum. It could have tipped either way, but the LACMA PR effort prevailed with the right players on board.

A few months later, in October, a much more tangible and even more ballyhooed cargo was transported across the city, the Space Shuttle *Endeavour*, which traveled 12 miles across the city, from Los Angeles Airport to the Science Center near downtown. Given the surprising popularity of the Rock's migration, there was some last minute panic about how to manage the anticipated crowds safely. But there was no way to keep people away from the much-hyped event, which went off without any incident, though hundreds of trees were felled, and at times the wing-tips were inches from buildings along the route.



Big Thing One: The Rock. LACMA's load was a 340-ton shrink-wrapped rock, spread out on a trailer with 196 wheels. The rig was 295 feet long, 21 feet tall, and 27 feet wide. CLUI photo



Big Thing Two: The Space Shuttle. The California Science Center's load was the 80-ton space shuttle: 78 feet wide, 122 feet long, and 50 feet tall on a 160-wheel trailer. CLUI photo



Big Thing Three: The Radioactive Steam Generator. Southern California Edison's load weighed 360 tons, requiring a 400 foot long truck with 192 wheels. CLUI photo



Traveling at around two miles an hour, and stopping often, the trip took three days, and cost about the same as the Rock (around \$10 million). Much was said about the irony of a craft that had circled the earth 4,700 times at speeds up to 17,000 mph taking three days to get through LA traffic.

The biggest of the three big things, though, was a bit of a dark horse. It had little in the way of promotion, in fact, the owners of it were hoping it would pass through the city as unnoticed as possible, which, compared with the other two, it did, even though it was—at 400 feet long—the largest and heaviest vehicle to ever pass through the streets of Los Angeles. The cargo was a steam generator from the San Onofre Nuclear Generating Station on the coast just south of Orange County, which was being hauled to a disposal site in Utah, 830 miles away.

Though it was junk, it was radioactive, so cutting it into smaller pieces would just generate more contaminated material. A custom superload truck was made, with a total weight for the truck and load totaling 1.6 million pounds. The generator was covered in thick paint so pieces would not flake off. Otherwise it was not covered, as its radioactivity was low—said to be equivalent to an x-ray, if you stood six feet away from it for an hour. Nonetheless, armed guards stayed with the truck all the time, especially when it was parked for the day by the side of the road and the rest of the crew were sleeping in motels.

The trip, started in early December, took 19 days. The truck traveled at around six miles an hour through Los Angeles, but up to 25 mph once it got out of the city. It went up Interstate 15, through Cajon Pass, then up the 395 through Owens Valley, then east on Highway 6 through Nevada, where it was allowed to travel during the day. It passed through Wendover, Utah, then on Interstate 80 eastbound to the Energy Solutions Radioactive Waste site in Clive, Utah.

There were four steam generators that needed to be disposed of, and this was the last of four trips made by the same truck following the same route over the last year and a half. Since then, the four new steam generators that replaced these have sprung leaks, causing the plant to be shut down. Maybe Southern California Edison should hold on to those trucks.

Superloads like this tend to be new engineered parts for power plants and refineries, often arriving by ship after being manufactured overseas. These three superloads represent exceptions. They also illustrate an arc of human achievement: the Rock is pre-existing material, a piece of the earth millions of years old, relocated to change its context and thus its meaning (from dirty quarry to clean museum); the Shuttle, born of human hands at the Rockwell plant in Palmdale 22 years ago, is a manufactured object, the pinnacle of American technological endeavor, reaching apogee in the sky, then coming to earth to live out the rest of its material existence as a relic in static display—a purgatory of preservation; and the Generator, a vessel spent to produce energy for the city, a waste product, so spoiled that it has to be entombed in the earth forever. These three things met, not in a temporal sense, but a spatial sense, on the roads of Los Angeles, on land ships passing in the night. ♦

*So imagine the newsletter at this point being like the three superload trucks that passed through Los Angeles in 2012; carrying a piece of earth artwork, the space shuttle, and nuclear industrial waste. Land art, Aerospace, and Radioactive Waste are three thematic program areas that the Center has been focusing on over the past year through research projects and exhibitions. So let's head down the road together, traveling with these three thematic loads.*

*First, we will look at land art as a means to end, and not just an end. One of the byproducts of land art that we have witnessed is something we refer to as the "land art sensory spill-over effect." This is the phenomenon where, as one approaches sanctioned land art, as the distance from it decreases, everything else on the way gets more interesting. And, once there, everything around it is imbued with a heightened significance and relevance. In the following articles on the subject, we will look at ways in which land art itself becomes a kind of perspectival modification device, changing the way visitors look at their surroundings.*

## A JOURNEY TO THE ENDS OF LAND ART

A POSITIVE SPIN AROUND A DOUBLE NEGATIVE



*Double Negative* is an example of the old practice of land art, where the terrestrial material of the ground itself is used as the raw material for the sculptural form. Though in this case, the form is created by the void left from the removal of the material at two spots across from one another, on the edge of the mesa, hence the double negative.

CLUI photo

LAST APRIL WE were asked to take a group of art history students from UCLA on a trip to visit *Double Negative*, perhaps one of the most iconic pieces of land art, made by Michael Heizer in 1969.

The trip was to take place around the opening of the exhibit *Ends of the Earth: Land Art to 1974*, a wide-ranging survey about land art at the Museum of Contemporary Art in Los Angeles. Though more than 80 artists were represented in the show, the two most renowned living "land artists" declined to participate, Walter De Maria and Michael Heizer, whose absence was especially apparent, as he was physically in town a lot of the time the show was up, preparing his *Levitated Mass* sculpture at the Los Angeles County Museum of Art. The other odd discordance was that MOCA actually owns Heizer's most famous land art work, *Double Negative*. With these interesting





The group of art historians from UCLA, including their professor, Miwon Kwon, listen to Count Deiro, second from right, describe his contribution to the construction of *Double Negative*. CLUI photo

absences and presences, positives and negatives, when asked to do the tour by the co-curator of the exhibit, professor Miwon Kwon, it seemed to us unavoidably inevitable.

We met the class in the morning as they emerged from their hotel at CityCenter, the new urban themed resort in Las Vegas, built by MGM and the Dubai World Investment Group, and the largest privately funded construction project in U.S. history, by some measures. CityCenter is comprised of a cluster of lurching 50 story towers and other buildings designed by the likes of Daniel Libeskind, Cesar Pelli, and Norman Foster, filled with expensive hotels, shops, restaurants, and condominiums, and stocked with semi-public art by the likes of Nancy Rubens and Maya Lin. With great aplomb and bombast, CityCenter forces one to conclude that there is no longer a difference between themed urban space, and actual urban space. It helps to convince one, too, that there is certainly more for us to learn from Las Vegas.

The group set out in three rented SUVs, needed for their high clearance on the roads ahead. At an off-ramp overpass for the new loop highway at the northern fringe of the city, we were joined, as planned, by Count Deiro, and his wife, Countess Joan, who had kindly agreed to speak with us at the *Double Negative* site, our next stop, another hour down the road, past Overton, and up the edge of Mormon Mesa.

Gathered at *Double Negative*, the group listened to Count Deiro as he gave his account of his connections to the project. It was Deiro who found this site and arranged for its purchase by the gallerist and land art patron Virginia Dwan, who later gave it to the Museum of Contemporary Art in Los Angeles. Deiro's photos mostly fill the book published by the museum. It was Deiro who showed Michael Heizer how to use dynamite.

"I want you to go away from here today knowing more about this work than anybody does," he told us. We also went away knowing more about the remarkable Count Deiro than most people do, and his story provides an interesting cultural context to the piece.

"Michael did not have this piece envisioned—so this is a case where the land, the mass, the environment dictated the impetus behind the artist's vision—so first he had to have the dirt, before he could envision the idea of taking away, making something out of nothing . . . the dirt came first," Deiro told us.

Deiro, who also goes by his first name Guido, is an Italian Count. His father was a Hollywood composer and accordian player who was married to Mae West for a time. After his mother remarried a bookie and gambler, Deiro became a mob kid in Las Vegas, and eventually a pit boss at the Sands during the Rat Pack period. He loved flying planes, and ended up developing local airports, doing charters, flying people in and out of Vegas, skywriting, and building up the aviation industry serving the casinos and the growing city.

Soon after the richest man in the world, Howard Hughes, came to town, in 1966, he bought the old main terminal at the airport and hired Deiro to run the local aviation side of the Hughes Tool Company, the original source of Hughes' personal wealth and the financial conduit for his most ambitious endeavors.

Deiro says Howard Hughes loved airplanes even more than women, and Hughes had big plans for aviation in southern Nevada, including a supersonic transport plane which was going to bring people there from places as far away as Japan in under four hours, opening Las Vegas up to the world. Mormon Mesa, where *Double Negative* is now, was one of the places Deiro looked at as a possible airport for the supersonic plane. The plan fell through, largely due to environmental and noise concerns (and the fact that Europeans developed the similar Concorde), so Hughes started buying casino hotels and land instead, and Deiro was involved in many of these transactions.

Deiro's engagement with land art began by a chance meeting. One day in 1968, Geoffrey Gates, a Wall Street financier who had commissioned some of Heizer's dry lake work (along with work by Robert Scull and others) came by the airport when Deiro was around, looking for someone to help him find *Rift 1*, one of Heizer's *Nine Nevada Depressions*, made in a dry lake earlier that year. Deiro had seen photos of desert land art pieces in *Life* magazine, and was intrigued. He had a sense of where it might be, and flew him to Jean Dry Lake, landing right next to the piece—a zig-zag trench dug in the dry mud.

"After that Geoff was very enthusiastic about meeting me," Deiro told us, "and he says, 'listen I'm going to tell Michael Heizer, and Walter De Maria, and Frank Stella, and Jeffrey Koons, and Virginia Dwan and Heiner Friedrich, and everyone down at Max's Kansas City about you.'" And sure enough, Deiro soon got calls from some of these New York City-based artists and collectors interested in finding land for sculptures, and was invited to New York to see their work. "I went to the very first sculpture show at Dwan," he said, "I went to the Guggenheim's retrospective, I met Dan Flavin, I met everyone, it was wonderful . . . I loved their work, I really did, I got to know them—and they liked me, I wasn't a competing artist—I was Guido, if you want something go to Guido."

He worked with Dwan, Charles Ross, Walter De Maria, and Michael Heizer, who he especially got along with. He and Heizer would hang out drinking at the Stardust, making big plans on cocktail napkins (napkins and other things Deiro would later give to the Nevada Museum of Art in Reno, which became the founding collection for the archives at the museum's Center for Art + Environment). With some promised resources from Virginia Dwan, Heizer asked Deiro to help him find sculpture sites in southern Nevada. Deiro thought of Mormon Mesa, the potential Hughes



SST airport site, and asked a friend who had bought hundreds of acres there thinking that it could be divided into lots and sold to people who had never seen it (a so-called Florida Scam, something that has been done on remote land throughout the southwest as well as Florida). The land he owned covered the edge of the mesa and the undevelopable slopes along its sides. After Deiro flew Heizer over it, Heizer's vision for a sculpture formed. Deiro bought the land from his friend and transferred it to Virginia Dwan. Then Heizer got to work excavating the crumbling sides of the mesa into *Double Negative*, starting in late 1969.

*Double Negative* was made without permits or engineered drawings. The form was blasted out of the living rock over three months by the artist himself, along with a small crew and earth moving equipment. 240,000 tons of earth were ultimately displaced, creating two 30-foot wide trenches hundreds of feet long. Deiro would drop off supplies periodically, including dynamite, but otherwise stayed out of the way. And so it came to pass.

After listening to the Count's account, and exploring *Double Negative*, the group left the mesa top for lunch and more stories at Sugar's Home Plate, a café and bar in Overton favored by bikers. After lunch, we parted ways with the Count and Countess, and continued on our way northward, to look for the site of *Las Vegas Piece*, an artwork also made in 1969, by Walter De Maria, a friend of Michael Heizer, and the other missing artist from the *Ends of the Earth* exhibit.

*Las Vegas Piece* was a geometric etching on the ground, composed of four connected lines, two of them a mile long, and two of them half a mile long, made by scouring a few inches off the top of the rocky soil with the eight foot wide blade of a grader. It's at a remote site down 35 miles of dirt road from the interstate.

Some would argue that it isn't there at all, that the piece is gone. Certainly, as originally intended by De Maria, the piece no longer exists, just as "none" of Heizer's dry lake pieces exist, even if traces can be found. Of course these are ruins of land art, not land art. But for a group of art historians, the interest in going there was not to experience the piece, but to experience the place where the piece was. To understand it better forensically, and archeologically. And to ground truth the land art that usually exists to us only in photographs—to verify its historic existence heuristically.

Only the faintest sense of the lines of *Las Vegas Piece* is discernable, and barely so enough to leave some unconvinced that they saw it at all—its existence is a matter of interpretation. It's on the limits of perception, conjured up in the mind's eye and space by lining up mountain ranges in the background of photographs in art history books with those in the distance of the actual site. In a parallaxed overlay, when the alignment lines up, the viewer descends into the photo at the same time the piece in the photo emerges into the viewer's live view. You are there, even if it is not.

The following day, after a night on the town at CityCenter, some members of the group visited the *Dig This* yard, where you can rent time on heavy earth moving equipment, just like those used to make *Double Negative* and *Las Vegas Piece*. For a fee you can dig trenches, make mounds, and move large tires and blocks around for

as long as you like. Only here, any land art you make is erased by the next patron. ♦



*Dig This* is an attraction in Las Vegas where patrons can use heavy equipment to dig holes, make piles, and move large objects around. CLUI photo

## SUN TUNNELS

AS A PERSPECTIVAL POINT RADIATING OUTWARDS



A crowd assembled at *Sun Tunnels* when the public was invited to meet Nancy Holt there on October 20, 2012, as part of the opening celebration for her exhibit *Nancy Holt: Sightlines* at the Utah Museum of Fine Art. CLUI photo

SUN TUNNELS, ANOTHER icon of land art, is in the northwest corner of Utah, on an empty plain that feels miles away from anything. The piece is composed of four large concrete tubes whose axis converge at, and diverge from, a central point. If you stand at that point, in the middle, where there is a small concrete pad, you look out through the tubes in four different directions. One direction is where the sun rises on the summer solstice; another, 180 degrees away, is where the sun sets on the solstice. Another points to where the sun rises on the winter solstice; and another points to where the sun sets on that day.

Nancy Holt, the artist who made the piece in 1976, often uses line of sight tubes in her work. She calls them "locators." It's a way of framing space and directing attention. Peering through a line of sight tube cuts off everything that surrounds you, focusing all your vision on the object at the end of the perceptual tunnel. One of the effects of looking through these tubes that she has observed is the collapsing of the distance between the viewer and the object being viewed—it brings the distant object closer without magnifying optics and in a more intimate way. Conversely, too, it takes the viewer out into the space being observed, through the tube.



The big tubes at *Sun Tunnels* are more than line of sight tubes, or locators—they are a sculptural embodiment of the annual cycle of the planet in the solar system. The X spot that they mark is a cosmological point of convergence, from which one can look out at the universe (confirmed by the fact that USGS topographical map for the quadrant covering the site marks them on the map as “Astronomical Observation Tunnels”). Though heavy and large, the piece is really immaterial, since it is about relationships between the viewer, the surroundings, and the cosmos.

The site, curiously, is a kind of terrestrial fulcrum as well. It is the middle one in a line of three pieces of land owned by Holt. Five miles east is a former gravel pit, and six miles west she owns the crest of a butte. One site digs into the ground, the other rises above it, with the axis point—the *Sun Tunnels* site—in the plane plain in the middle. This may be an accident, or not, since the land was acquired by her around the same time. Either way, it is a fact, and adds a terrestrial dimension to this perceptual nidus.

Standing in the middle of this observatory, the view extends in the space between the tubes as well. Looking in these gaps, one imagines, rather than a cosmological connectivity, the continuity of places of the ground. If this is the center, for the moment, what then is around us, and beyond the limits of our sight, in the terrestrial horizons between the tubes? Does their meaning shift when perceived through the context of the *Sun Tunnels*? Here are a few possibilities:



**Root Cellar as Unoccupied Subterranean Void** CLUI photo  
*Distance from Sun Tunnels 3.5 miles N by NW at a bearing of 326 degrees.*  
 The nearest building to *Sun Tunnels* is an old root cellar at the old town site of Lucin. If *Sun Tunnels* is a kind of observatory, the root cellar could be considered as a *terrarium*, an observatory of the solid mass of the ground.



CLUI photo

### Lucin Airstrip

*Distance from Sun Tunnels 4.5 miles N at a heading of 12 degrees.*

The nearest occupied structure to *Sun Tunnels* and the only habitation for miles around is the home of a man named Ivo Zdarsky. Zdarsky is the inventor of an aircraft propeller, the *Ivoprop*. In 1984, he built an airplane from scratch using a Trabant car engine, and flew it 30 miles from his former home in Czechoslovakia to Austria to escape communism. Now he lives here alone in a hangar. In the context of *Sun Tunnels*, he could be imagined as a kind of Icarus, a sky flyer coming down to earth in this empty plain.



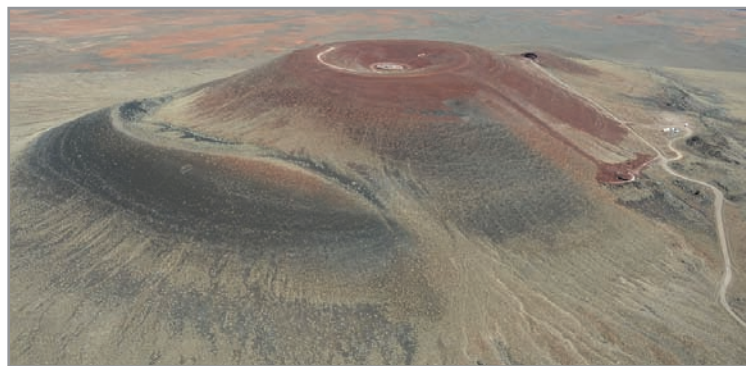
CLUI photo

### Williams Federal #1 Oil Well

*Distance from Sun Tunnels 11.7 miles E at a heading of 110.4 degrees.*

There is an old oil well near *Sun Tunnels*, a deep shaft into the ground, capped with a steel pole. The road that provides access to *Sun Tunnels* dead-ends at the well. 53 miles away E by NE, with little but the Great Salt Lake between them, is *Spiral Jetty*, a work of land art made by Nancy Holt's husband, Robert Smithson, which also was built at a remote location that was accessible because of a road made for an oil well. ♦

## ON THE WAY TO RODEN CRATER AMONG THE MOUNDS AND CRATERS OF NORTHERN ARIZONA



*Roden Crater*, James Turrell's unfinished earthwork, is one of many craters in the area modified by the hands of man. CLUI photo

JAMES TURRELL'S RODEN Crater is perhaps the most elaborate, anticipated, and delayed land art project in the nation. While it remains a perpetual construction site for the foreseeable future, and closed to the public, it is not the only transformed crater in the neighborhood. This remarkable region, known as the San Francisco Volcanic Field, is peppered with hundreds of cinder cones and lava flows, with landscapes that range from the supremely trammed, to the utterly impassable. There are dozens of curiously altered landforms here, potential perceptual and interpretive attractions, at a crater-themed landscape discovery park, free and open to the public, for the most part.



This is a chaotic land of dirt roads, sand traps, dead-ends, ranches, and right-angle turns, due to abrupt topographic shifts, loose drainage channels, and irregular land ownership, a mix of federal, private, and state lands, in the common checkerboard arrangement of alternating square mile township and range sections. On the east side the border is abrupt, at the canyons of the Little Colorado River, and the Navajo Nation, another place altogether. Out of bounds.



Sheep Hill is one of a few cinder cones in the volcanic field that has been deconstructed to form a sculptural monument to construction. At its base, its constituents are sorted in bins, arranged by color and texture, like unmixed paints on a palette, extracted from a painting in reverse. CLUI photo

There are just a few paved roads into the area. The main one is Highway 89, heading east then north out of Flagstaff. On the northeast side of town is Sheep Hill, one of several cinder cones in the area that are dug up commercially for the textured rock. Cinder Haul Road curves up the hill, much of which is now gone, spread around elsewhere in the state. At the base of the hill are some of the provisioners of this mountain: AZ Materials Inc., and the Landscape Connection, Inc., Materials and Yard Décor. A few miles east in Winona, the Darling Pit has similarly eaten up much of Cinder Mountain. North a few miles are some pits west of Robinson Crater. Confusingly, around here mounds can be craters, and craters can be mounds, some naturally formed, some created by man's hand.

Continuing out of town, as Highway 89 curves north, is Old Caves Crater. If you take a right after the mound, you will be on Cinder Lake Landfill Road, headed to Cinder Lake Landfill, a contemporary



One of the remaining craters at Cinder Lake that were formed through a choreographed explosion to construct a model of the moon's Sea of Tranquility. CLUI photo

mound of effluvia and ejecta constructed by local residents—this is the main landfill for the city of Flagstaff. Just north of the landfill is Cinder Lake, a flat pan of black ash, where people drive dirt bikes in circles and spirals in an officially sanctioned Off-Highway Vehicle Area. It is a remarkably granular and soft surface, like a giant bowl of rough gravelly marbles. A few isolated full-grown pine trees poke up from the otherwise denuded black waterless lake of coarse pebbles.

In the 1960s, Flagstaff's Astrogeology branch of the USGS created a version of the lunar surface here to train astronauts. A duplicate of the lunar craters found in the Sea of Tranquility (the proposed landing site for the first Apollo mission) was created here using buried explosives precisely scaled to form the right sized craters, and sequenced so that the ejected debris would fall in the correct layered order over one another. Over the course of a decade, future astronauts trained here, often fully suited, learning to use the tools for observation and sampling that were to be employed on the real lunar surface. The lunar rover drove all over this surface before going to the moon, making this possibly the only extra-terrestrial OHV area in the country open to the public.



Sunset Crater, spared from an explosion for a film production, is now an off-limits park. Though there is a visitor center and a walking trail at its base, nobody is allowed to climb the crater anymore. CLUI photo

Further up Highway 89 is the Sunset Crater, the youngest crater in the region, formed in a series of eruptions, some less than a thousand years ago. Its form and formation is typical of many of the older cinder cones here. During the eruptions, most of the magma came out explosively as ash and rock scoria, which blanketed the region. This ejecta was emitted sporadically, over days, weeks, and months, often as a fountainous cloud of liquid rock and gas, at 2,200 degrees, cooling and solidifying before it hit the ground. It piled up, making a mound of cinder whose sides rest at the angle of repose, 33 degrees. Gases emitted during the eruptions chemically reacted with the black basalt, forming iron oxides, giving many of the mounds a reddish hue. Additional colors on these rubblely slopes are lichens, the early colonizers of this new land.

Sunset Crater became a National Monument in 1930, and is managed by the National Park Service. This came about after a plan to dynamite the side of the crater, in 1928, led to federal intervention to protect it. The proposed detonation was to create an avalanche for a Hollywood western film, *Avalanche*, based on a Zane Gray novel. (The Hollywood dynamiters were more successful in



Cameron, Arizona, where they used a few too many explosives, and ended up showering rocks on the crew, and killing one spectator).

Since 1973, visitors have been forbidden to climb Sunset Crater, as the loose cinders of the slopes were being damaged by foot traffic. Instead, a walking trail was constructed at its base. After a few hundred yards of pavement, the trail enters the Bonito Lava Flow. A quarter or so of the magma that came out of Sunset Crater flowed, rather than spewed, creating this flowscape of lava. Beneath the surface crusts are layers of scabby flow formations as much as 100 feet deep, where hollow lava tubes have ice that lasts throughout the year.

This is one of the most jagged terrains imaginable—brittle, lightweight piles of crusting convolutions, that break, scatter, and clink. It is nearly impossible to walk through it if not for this constructed trail. The trail leads to a lava tube that partially collapsed recently and is now closed to the public.

The Park Service also manages the Wupatki National Monument, several miles away. There, the ruins of some old Indian pueblos, left from settlements that date back more than a thousand years, serve as a reminder that people were here to witness the dramatic eruptions that created Sunset Crater. It must have been quite a show.



Line of sight tubes on the overlook promontory at Meteor Crater.

CLUI photo

Though it lies 15 miles outside of the San Francisco Volcanic Field, one cannot exclude Meteor Crater from a discussion of the craterscape of northern Arizona. An anomalous coincidence of craterness, Meteor Crater was not formed by eruptions, but by the explosive impact of a 200-foot long meteorite 49,000 years ago. It is possibly the largest, most distinct meteor crater in the world, 4,150 feet wide, circular, with a raised rim of ejected material around it. Like Cinder Lake, the well-preserved crater was used as a training site for the Apollo program. Though unlike Cinder Lake you cannot drive around in it.

The visitor experience at Meteor Crater, which has been operated as a popular and privately owned tourist attraction for many decades, is robust. There are overlooks on the edge of the crater with line of sight tubes, a crater-rim trail, a museum with displays about

astrogeology, a “stand at ground zero” room, an introductory film, and windows framing views outward, like paintings in a picture frame.

With such a variety of possible perceptual experiences, Meteor Crater is currently the most complex and sophisticated perceptual crater experience among the many in the craterscape of northern Arizona. It’s like a populist version of Roden Crater, only 30 miles away. *And*, it’s open. ♦



Crater, museum? Sometimes they are two sides of the same coin.

CLUI photo

## VALLEY CURTAIN CALLS RUNNING FENCE RUNS ON



Rifle Gap, Colorado, where the anchors that once held the *Valley Curtain* in place remain on the ground, evoking a kind of *ghost curtain* in its place.

CLUI photo

IN THE 1990s, the artists Christo and Jeanne-Claude first proposed hanging six miles of silvery curtains over the Arkansas River, in southern Colorado, west of the Royal Gorge. Hung from steel cables anchored to the high steep banks of the river, it was to remain there for two weeks, and be high enough above the water to let recreational rafters pass easily underneath it, enjoying the view. After spending \$6 million so far on studies, plans, and proposals, the project is still working its way through the various hurdles that have emerged to stop it, most recently a lawsuit filed by an organization called Rags Over the Arkansas River (ROAR). While we wait to see how this plays out, not holding our breath, let’s revisit two other Christo/Jeanne-Claude art sites to see what we can find, and to explore how their temporary installations might actually linger on, physically, afterwards, and how the echoes of the work might continue to reverberate in unanticipated, but provocative ways.



### A VISIT TO THE VALLEY CURTAIN SITE

Christo and Jean Claude have, of course, hung curtains in Colorado before. In 1972, the *Valley Curtain* project succeeded, after a failed attempt a year earlier, in hanging a thousand-foot wide orange curtain across a canyon known as Rifle Gap. The curtain remained there for 28 hours until it was destroyed by winds.

Rifle Gap is now, as it was then, a narrow canyon a mile long, with a two-lane road going through it. At the north end is the Rifle Gap Dam, built by the Bureau of Reclamation in 1967, and the Rifle Gap Reservoir, behind it. At the southern end is a golf course and resort. The land of the Gap is part of Rifle Gap State Park.

The curtain was hung at the narrowest point in the canyon, near its southern end. A main cable, 1,368 feet long, composed of a set of four cables next to each other, supported the curtain, which was hung from 11 clamps along the cable. The cable was strung from two concrete anchor points, one on either side of the canyon, each weighing more than 850 tons, which were poured onto the solid rock walls of the canyon. Tie-down lines at the bottom of the curtain were connected to 27 concrete and steel anchors on the floor of the valley.

Today, many and probably all of the concrete and steel tie-downs are still there, though none of them are very apparent. They lurk in the grass and among the rocks on the lower slopes of the canyon. Steel beams and other scattered concrete bricks were found on the slopes as well. A number of steel anchor points were bolted to rocks, and are still attached. Both of the main concrete cable anchors were visible high up on either side of the canyon. It should be noted that none of this material would be visible if you were not looking for it, and once discovered it seems to enrich the site, rather than detract from it. Though the curtain is no longer there, the remnants suggest its existence, and confirm the site. They also frame the view, suggesting other curtain-like forms in the valley:



#### Collapsed Plastic Curtain

There was a closed turn-out on the road through the Gap, with a shelter and a public restroom, just a few hundred yards from the curtain site. Barrels had been used in an attempt to indicate that the facilities were considered closed by (presumably) park maintenance crews. Strung from the barrels was plastic fence material of the type found at construction sites. Much of this fence material had fallen on the road, due possibly to the strong winds in the area.

CLUI photo



CLUI photo

#### Snake Curtain

A snake of unknown variety was seen heading towards the Gap and the curtain site. It was noted that the shape of the snake, thick in the middle, tapered at either end, and undulated over its length, resembled the form of the curtain.



CLUI photo

#### Dam Curtain

It was rather apparent that the Rifle Gap Dam, a mile from the curtain site, was a kind of curtain too. It spans the canyon from side to side (of course, the canyon continues past the dam, though it is submerged). It also holds back another curtain-like form: the wall of water behind it.

### A VISIT TO THE RUNNING FENCE SITE

The year *Valley Curtain* was completed the couple began work on *Running Fence*, one of their most ambitious projects. It called for constructing a 24.5-mile long, 18-foot tall fabric fence across northern California's Sonoma County. The fence was made of 2,050 steel poles, topped by a cable, from which sections of the fabric fence was suspended. It took four years to prepare, cost \$26 million (of their money), and required an Environmental Impact Statement that extended to 450 pages.

The completed piece was up for two weeks, in September 1976, and then was taken down, as promised. The poles were uprooted, and all the earth anchors that held the lateral guy wires, two for each pole, were hammered three feet into the ground, to be out of the way of plows and mowers. The poles and the fabric were offered to the 59 private property owners who agreed to have the fence cross their land, with the rest scrapped. A number of the ranchers accepted and found new uses for the material. Here are some of the lasting *Running Fence* monuments still extant in the hills and dales of Sonoma County:





### Running Fence Powerline

CLUI photo

At one ranch, *Running Fence* poles were reinstalled in the ground to support an electric line running to a pump in a pond.



CLUI photo

### Running Fence Dropcloth

Fence fabric has been draped over the rafters in barns and outbuildings to keep barn swallow droppings and bat guano out of work areas.



CLUI photo

### Running Fence Flagpole

*Running Fence* ran from Highway 101 at one end, to the ocean on the other. Along the way it crossed fourteen roads, where a gap was left open so traffic could pass. It also went through one downtown, the small community of Valley Ford, where it crossed the road next to the post office. This pole was cemented into the ground, and was not removed—it was transformed into a flagpole and left as a monument commemorating the piece. A brass plaque at the base of the pole describes the project, and states that “no visible evidence of *Running Fence* remains on the hills of Sonoma and Marin Counties today.” That, apparently, is disputable. ♦

The Lay of the Land

## PHOTO CALIBRATION TARGETS

TERRESTRIAL TEST PATTERNS USED FOR AERIAL IMAGING



Three tri-bar targets remaining at Cuddeback Lake are visual analog relics of the aerial viewing revolution, and they may be the only ones on public land. With dendritic cracks filling with brush, breaking through the uniformity of the 5:1 bars (each bar and space between the bars is five times as long as it is wide), the flat surfaces are peeling, crumbling and sprouting, producing dimensionality and relief. CLUI photo

THERE ARE DOZENS of aerial photo calibration targets across the USA, curious land-based two-dimensional optical artifacts used for the development of aerial photography and aircraft. They were made mostly in the 1950s and 1960s, though some apparently later than that, and many are still in use, though their history is obscure.

Most of them follow the same general form established by the Air Force and NASA (and prior to 1958, its precursor agency, NACA): a concrete or asphalt pad constructed flat on the ground, 78 feet by 53 feet, coated in a heavy black and white paint. The pattern painted on the targets is sets of parallel and perpendicular bars duplicated at 15 or so different sizes, and, sometimes, a large white square. The configuration is sometimes referred to as a 5:1 aspect tri-bar array, and follows a similar relative scale as a common resolution test chart known as the 1951 USAF Resolving Power Test Target, conforming to milspec MIL-STD-150A. This test pattern is still widely used to determine the resolving power of microscopes, telescopes, cameras, and scanners.

The targets function like an eye chart at the optometrist, where the smallest group of bars that can be resolved marks the limit of the resolution for the optical instrument that is being used. For aerial photography, it provides a platform to test, calibrate, and focus aerial cameras traveling at different speeds and altitudes. The targets can also be used in the same way by satellites.

Many of these resolution test targets are found in the Mojave desert of California, one of the principal development and test areas for surveillance aircraft. Some of the most advanced aircraft made by the nation, like the A12 and SR-71 Blackbird and the U-2, were unarmed, and designed to be used only as flying cameras. The photo targets were most certainly used by these planes.

Cameras have been installed on many other types of aircraft of course, even the experimental rocket plane the X-15, which still



holds the record for the fastest manned aircraft, and which flew over these skies in the 1950s carrying Fairchild and Hycon cameras that used these grids as well. Drones, flown extensively in the Mojave, were also developed as camera platforms, initially at least.

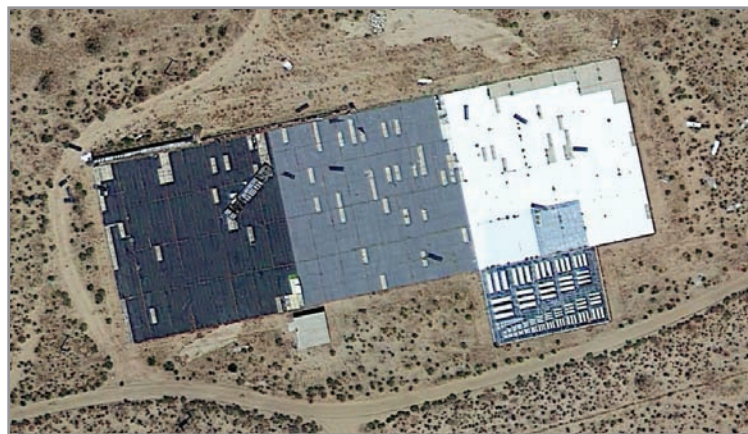
The largest concentration of calibration targets in one place is on the grounds of Edwards Air Force Base, in an area referred to as the photo resolution range, where 15 calibration targets run for 20 miles across the southeast side of the base in a line, so multiple targets can be photographed in one pass. There is some variation in the size and shape of the targets at Edwards, suggesting updates and modifications for specific programs. A number of the targets there also have aircraft hulks next to them, added to provide additional, realistic subjects for testing cameras. Some of these planes are themselves unusual and rare military jets, officially in the collection of the base museum, despite being left out on the range.

There are an unknown number of other isolated photo calibration targets across the country, mostly inside restricted groundspace at military areas, such as at Eglin AFB, Florida; the Nevada Test Site; around Walker Field, a Navy drone airport in Maryland; and an especially exotic one at Fort Huachuca, in Arizona. Several others are painted on existing taxiways and runways, such as at Wright Patterson AFB, Ohio; Travis AFB, California; Beaufort Marine Corps Base and Shaw Air Force Base in South Carolina.

There are other kinds of sites that have two dimensional targets used for testing and developing multispectral satellite and aircraft sensors in and beyond the visible spectrum range. At NASA's Stennis Space Center in Mississippi, for example, there are painted concrete edge targets (which use larger solid black and white blocks), a 130-meter wide fan-shaped Painted Concrete Radial Edge Target, and 45 2.44-meter wide discs, evenly spaced throughout the site for calibrated viewing from above. Even 136 fixed manhole covers on site have been painted with reflective paint to bounce signals back from airborne sensors.

Though apparently still used for some optical camera testing and calibration, the standard tri-bar photo targets are definitely a thing primarily of the past. The 1951 Resolution Test Chart on which it is based is more than 60 years old and was designed for film cameras, and predates high-resolution digital systems and CCDs. The arrangement and spacing of the lines is not well suited for computer analysis (it's not a continuous single row, but two or three rows of pairs), and it has other frequency and modulation issues that make determining sharpness by digital means inaccurate. The Air Force officially cancelled MIL-STD-150A for photographic lenses in 2006, without replacement. ♦

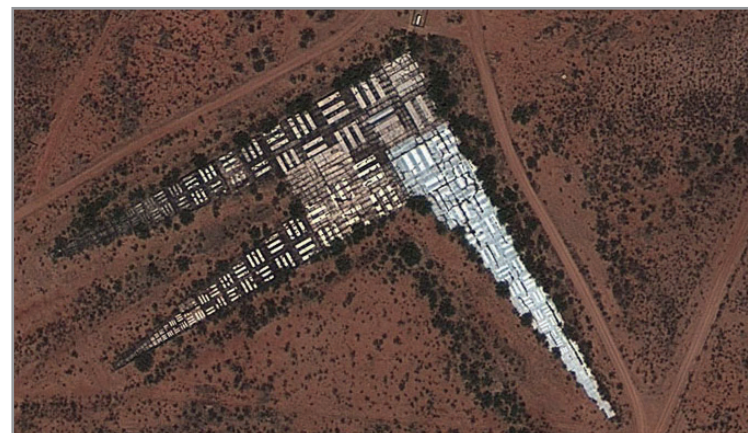
*A CLUI selection of photo calibration targets is on view in the exhibit Free Enterprise: The Art of Citizen Space Exploration in the University of California Riverside Sweeney Art Gallery, January 19 - May 18, 2013.*



GoogleEarth image of a standard tri-bar test pattern on the Photo Resolution Range at Edwards that has been greatly expanded.



GoogleEarth image of a standard tri-bar test pattern off the runway at Walker Field, Maryland.



GoogleEarth image of an expanded tri-bar array at Fort Huachuca, Arizona.

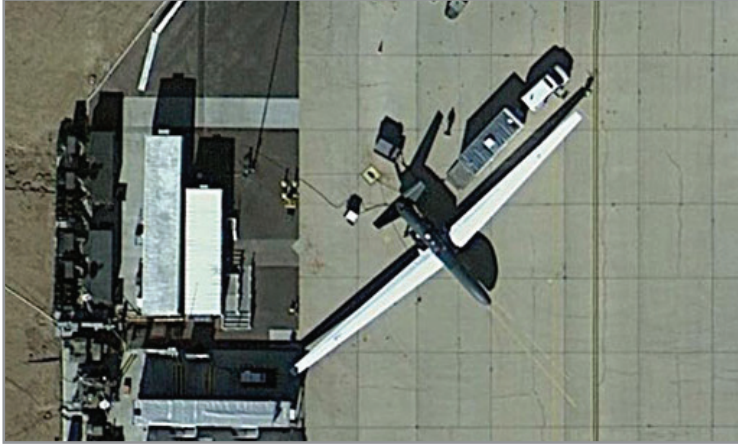


GoogleEarth image of a tri-bar array at Eglin Air Force Base, Florida.



## UNMANNED AERIAL VEHICLES

### PROLIFERATING SURVEILLERS OF THE LAND



GoogleEarth image of a Global Hawk drone aircraft being serviced at Plant 42 in Palmdale, California.

NO MATTER WHAT you call them, UAVs (Unmanned Aerial Vehicles), RPAs (Remotely Piloted Aircraft), UACs (Unmanned Aircraft Systems), drone-ish aircraft are proliferating. While their use in overseas battlefields is now well established and notorious, their deployment, domestically, is still up in the air. How to integrate them into public airspace, so they do not conflict with current aviation, and maintain safety and privacy for people on the ground, is being worked out by the FAA and others now.

Drones are flown from dozens of existing military airfields around the country, and are spreading quickly to the rest. (The Air Force trains more drone pilots now than they do fighter and bomber pilots combined.) Military bases where they are used sometimes have runways dedicated to drone storage and traffic. Companies that build them test them at military and civilian airports, and in some cases have their own dedicated UAV R&D airports. Maybe it's time to acknowledge a new kind of airport now: a Droneport. Since we are on the cusp of this game-changing moment of aviation in the USA, let's take a look at some of the places where these new birds roost.

Edwards Air Force Base, the historic test site for nearly every military aircraft developed in the USA, is where many of the large drones are now tested too. Drones have been flying from here since WWII. NASA's Dryden Flight Research Center at Edwards has a few drones of its own. In May 2012, Boeing's Phantom Eye, a new high altitude reconnaissance platform that uses hydrogen fuel to keep it aloft for long periods, made its debut there. In 2011 the company's Phantom Ray, an aptly named manta ray shaped stealth UAV, was flown to Edwards from Boeing's Phantom Works plant, in St. Louis, on the back of the 747 used to carry the space shuttle, to make its maiden voyage at Edwards. At Northbase, a remote compound at Edwards with its own runways at the north end of Roger's Dry Lake, new hangars and office trailers have gone in recently, with work being done on some kind of secret UAV, some say.

These high altitude, persistent aircraft are one type of drone, whose function is to stay high enough up, around 65,000 feet, to

be out of the way of other planes, out of reach of many ground-based missiles, and to loiter and observe, using high resolution optics or other sensors to see the ground. They can also be used as radar platforms, and relay stations. These craft tend to be large. In addition to Boeing's models, AeroVironment is developing the Global Observer, with a 170-foot wingspan, for this type of use. Northrop Grumman's Global Hawk, with a 130-foot wingspan, has this capability as well.



GoogleEarth image of Beale Air Force Base, where a U2 and a Global Hawk can be seen sharing the flightline.

Some of these planes are based out of military airfields that have a history of high altitude observation, where the SR 71, U-2, or other spy planes were (or are) based, for example, like Beale Air Force Base in northern California. On the east coast, the Webster Field Annex of the Naval Air Station at Patuxent River is the Navy's main UAV drone base. A Global Hawk based there recently crashed near Bloodsworth Island, across the bay (June 11, 2012). Lockheed's RQ-170, a large, high-flying drone shaped like the stealth bomber, is built by Lockheed's Skunkworks in Palmdale, California, and is flown around the world from control stations at the Tonopah Test Range and Creech Air Force Base (on opposite ends of the Nellis Range in Nevada). It was a RQ-170 that loitered high above Bin Laden's compound the night he was killed, and it was a RQ-170 that crashed in Iran in 2012.

The most notorious drones are the ones that can be used at low and high altitudes, and can carry a variety of large observation and sensing packages, as well as weapons. The two most commonly used of this type, at the moment, are General Atomics' Predator and Reaper, the hunter/killer drones. The Reaper, a larger version of the Predator, has a wingspan of 66 feet, and a payload capacity of 3,000 pounds. In addition to shooting things like Hellfire guided missiles, it can carry minidrones under its wings, which fly off and deploy weapons of their own.

General Atomics, based in San Diego, is a company with roots in early internet infrastructure (it operated a supercomputing center, and InterNIC, the governing body for all domain names, until 1998), as well as atomic power. It has been building drones for the CIA since the 1980s, based out of a desert airfield at El Mirage, California, which it still operates.

General Atomic's Gray Butte Flight Operations Facility is a dedicated R&D droneport a few miles south of the El Mirage site. The former desert auxiliary airfield was converted into a radar-cross section test facility by McDonnell Douglas in the 1970s, and used





GoogleEarth image of Gray Butte droneport, California.

for stealth research. It was sold to General Atomics in the early 2000s and converted into an airport again, but not one intended for manned aircraft. It is here that much of the work on the Predator and its bigger version, the Reaper, was performed, as well as on the company's new Avenger model, a bigger and faster jet-powered version of the Reaper, recently approved for deployment.

Predators and Reapers are housed at more than ten military bases around the country, as well as many more overseas. Outside of California, they can be found at the local airport for Syracuse, New York, where a National Guard base on the southern end of the airport converted from F-16 jets to MQ-9 Reaper UAVs in 2010. And at Ellington Field, a civilian airfield near Houston, where a military reconnaissance wing flies the MQ-1B Predator drones around the world. Creech Air Force Base, on the Nellis Range in southern Nevada, was the home of the first official Air Force Squadrons to fly the Predator and Reaper UAVs. Formerly known as Indian Springs Auxiliary Field, which supported the nuclear testing program, the base was renamed, repurposed, and expanded in the early 2000s, to become the most active UAV base in the country, where many of the killer missions over Iraq and Afghanistan were flown.

Despite their versatility and fame, the Predator/Reapers are not the most prolific UAV (due to cost too—the MQ-9 model Reaper program called for 57 planes, at a total cost of more than \$11 billion). Small *over the hill* reconnaissance drones, with wingspans ranging from 20 to two feet, are in use by militaries all over the world (more than 45 nations are known to fly drones), and more



GoogleEarth image of two droneports at Fort Huachuca, Arizona, used by Hunter and Shadow UAVs. Reapers are also based out of Fort Huachuca, to monitor the Mexican border.

than 20 nations manufacture them. This is the class of UAVs that is beginning its proliferation into civilian uses, including environmental mapping, police surveillance, and filmmaking.

The big aerospace companies all have drones in this category too, sold to the military for reconnaissance, such as Lockheed's two pound Desert Hawk; Boeing's 40-pound Scan Eagle (built by a new small UAV company within the company called Insitu); Honeywell's 16-pound T-Hawk; and the 28-pound Aerosone, the first UAV to cross the ocean (in 1998), built by AAI Corp., a division of Textron, based in Maryland, which also makes the popular Shadow, a 375-pound mid-size surveillance drone, in use at around 20 bases in the USA. The FAA recently permitted the Shadow UAV to be flown out of Benson Municipal Airport, in Arizona, the first time a UAV has been officially permitted to share runways at a general aviation airport.

The company that currently dominates the small drone market is AeroVironment, an independent company with roots in human powered and long range solar powered aircraft, designed by its visionary founder Paul MacCready Jr. (whose solar and pedal-powered planes are displayed in the Smithsonian Air and Space Museum). The company is based in Monrovia, California, east of Pasadena, with production and R&D in Simi Valley. The company has produced what is possibly the most common UAV, the hand launched, four-pound RQ-11 Raven, which is used for surveillance, equipped with a rugged PTZ (pan, tilt, zoom) camera, that can transmit live video and infrared over several miles. 10,000 of these have been sold to the military, and are used all over the world. The company also makes the tiny WASP, a quiet, one-pound UAV, used by Special Operations, and capable of transmitting video line-of site for three miles. The company is also marketing the Qube, a small four-rotor quadcopter that fits in the trunk of a car and transmits PTZ video, for use by law enforcement.

These planes are high quality production versions of what civilian hobbyists have been making on their own, converting remote control model airplanes into DIY drones, equipped with videocameras, and flying them in parking lots, parks, and RC airports across the land. The technology of these small military drones is beginning to enter the marketplace of mass production at reasonable costs, enabling many more of us to have the over the hill view. Like GoogleEarth, this will empower many, and possibly dismay many more. *We'll see.* ♦



GoogleEarth image of AeroVironment's UAV production center on Enchanted Way in Simi Valley, California.



## THE AIRCRAFT BONEYARDS OF AMERICA

WHERE THE OLD BIRDS GO TO DIE



View looking east over the boneyard at Davis-Monthan Air Force Base. For detailed (though ten years old) information about the aircraft in these areas, row by row and plane by plane, see Chris Slack's website: [www.amarcexperience.com](http://www.amarcexperience.com) CLUI photo

TUCSON'S BONEYARD IS the largest collection of aircraft on the planet. Though it has been known for some time that this was a place to see, many who live in Tucson never get around to it. So when Matthew Coolidge, director of the CLUI, was visiting the University of Arizona, he took a class of art students there. Sometimes it takes an out-of-town visitor to help people appreciate what is in their own backyard.

And what a backyard it is. This is where all the surplus military aircraft in the USA goes to be stored or dismantled. There are around 4,500 airplanes here at any given time, covering nearly five square miles. It's a fleet second only to the 5,500 active manned aircraft in the U.S. Air Force, and those, of course, are spread out all over the world, and still fly.

The site, at Davis-Monthan Air Force Base, was selected as one of a number aircraft storage sites for the more than 100,000 surplus aircraft that returned to the USA after World War II. It evolved into the primary location for all the armed services, when other sites were slowly emptied, shut down, and converted to civilian use. Southern Arizona is well known as having some of the best weather for flying in the country, a fact attested to by the high number of airports in the region (as reported in the CLUI newsletter in 2007). Also, low humidity and alkali soil helps to limit corrosion, and the hard desert ground makes it possible to move heavy equipment around without pavement.

Technically, of course, it's not simply a boneyard. It's the operating location for the Air Force Materiel Command's 309th Aerospace Maintenance and Regeneration Group, known as AMARG. 550 mostly civilian employees work there to store the planes in various states of limbo and demise. Some are expected to be here for short periods, months or years, and are kept flyable—a status known as flying-hold. Others are expected to fly again, someday, so are kept in flyable condition, but stored with more levels of

preservation and more of the sensitive parts removed. Other planes are designated officially as excess, and are for sale, usually bought, through politically charged negotiations, by friendly foreign militaries. Planes considered surplus that are not sold are broken up for parts, which are used domestically and sold internationally, and, eventually, the remains are scrapped.

The range of aircraft at the boneyard is, of course, vast. Fighter jets, helicopters, surveillance aircraft, transport, tankers, and bombers. Even ICBMs have been handled here. Famously, 365 B-52s were eliminated here in the 1990s, as part of the START I treaty, their wings chopped off with a 13,000 pound guillotine, and later with saws. Many of the visibly disabled aircraft left exposed to Russian satellites for verification, remain so, mostly in Area 26.

The boneyard at Davis-Monthan, by far the largest in the country, is also the most accessible. Public tours of the facility are managed by the Pima Air Museum, located next door, and they often sell out. Visitors are confined to the buses, but get a good general view of the site on the tour.

### CIVILIAN BONEYARDS

There are several non-military boneyards around the country, where airliners and jets are stored and scrapped, though none of them offer regular tours. These airports are usually considered aircraft storage sites, where airplanes sit idle, sometimes for years, and by the hundreds, while waiting out some fluctuation in the aircraft industry, usually as a response to economic conditions, or consolidation, downsizing, or bankruptcy, or when an aircraft type is being phased out of service. These planes are often sold to other carriers in South America or Africa. Airports that serve as transitional parking fields for grounded planes, though, usually also have boneyards too, where stored planes that pass through purgatory, for whatever reason, may be used for parts for awhile, then scrapped. At some of these airports, once a plane is parked there, there is less than a 20% chance that it will fly out.

The number of grounded commercial airliners in the country is a direct reflection of the overall economic condition of the country. At the moment there are more than 1,000. Most of these can be found at six airports in the southwestern USA, three of which are in southern Arizona.



Kingman Airport, AZ

CLUI photo

This airport, in northwestern Arizona, was one of the largest WWII aircraft storage and redistribution sites in the country, with more than 10,000 planes sold and scrapped here. Today Kingman Airport has little traffic, and stores more than 100 commercial airliners, some of which are destined for the airport's teardown companies, like Kingman Aviation Parts, Inc.





### Phoenix Goodyear Airport, AZ

CLUI photo

West of Phoenix is Phoenix Goodyear Airport, formerly the largest aircraft storage site for the Navy, Marines, and Coast Guard. It was closed in 1968, with the remaining aircraft moved to Davis-Monthan. Now it is a reliever airport for Phoenix's main airport, Sky Harbor, and a major European pilot training center. It is also an aircraft parking lot, though typically with less than 50 aircraft stored there, some being parted out by the Aeroturbine Company.



### Pinal Airpark, AZ

CLUI photo

The largest civilian boneyard in Arizona, and the second largest of the six or so nationwide, is Pinal Airpark, north of Tucson. There are currently around 200 commercial airliners on site, many from Northwest Airlines, which ceased to exist in 2010. The airport is also a major aircraft maintenance center with an interesting history. It was constructed as Marana Army Airfield during World War II, as a training field with five outlying airfields. During the Vietnam War, the airfield was dominated by the CIA, and used as one of the Agency's primary facilities for global covert air operations. CIA false front aviation companies operated here, including Intermountain Airlines. The CIA presence continued through the Cold War, and possibly continues in some form. Most of the business here is conducted by the Evergreen Maintenance Center.

The Lay of the Land



### Roswell International Air Center, NM

CLUI photo

This city airport, a former Strategic Air Command bomber base in southeastern New Mexico, often has the largest inventory of grounded civilian airliners in the country (currently over 200) including a number of American Airlines airbuses. Parts salvaging and dismantling is conducted by Stewart Industries and others.



### Mojave Airport, CA

CLUI photo

Located less than two hours north of Los Angeles, the Mojave Airport boneyard has been appreciated by tourists and the film industry for many years, and until recently the airport management could be persuaded to take visitors on boneyard tours. Things have changed at the airport a bit since Scaled Composites launched a plane into space from the airport, and then was sold to Northrop Grumman. The large aircraft storage area on the northwest end of the airport currently has less than 30 planes, and much of it has been taken over by wind energy companies, whose wind arrays nearby are expanding quickly. But the boneyards on the northeast side of the runway remain robust, possibly the scrappiest of the aircraft scrapyards, with about 100 airplanes there, all of which are doomed.



### Southern California Logistics Airport, CA

CLUI photo

Much of the aircraft storage business at Mojave has shifted to Southern California Logistics Airport, near Victorville, a former fighter base that was closed in the 1990s. This airport now has a capacity for 300 planes and currently has more than 100 pickled transitional aircraft, as well as a scrapping operation at the site. ♦



## PERPETUAL ARCHITECTURE

## URANIUM DISPOSAL CELLS OF AMERICA



Uranium disposal cells, like this one in Mexican Hat, Utah, are tombs in a sense, like the Egyptian pyramids. They are time machines, intended to take their contents into the future.

CLUI photo

URANIUM DISPOSAL CELLS were the subject of an exhibit opened at the CLUI Los Angeles in June 2012. The exhibit featured glowing LCD screens with black and white images of a selection of the engineered mounds, taken by the CLUI over the last year, and touchscreen maps that provided more images and information about these structures across the country.

Uranium disposal cells are unusual constructions because they are built to last far beyond the lives of most engineered structures, to isolate their radioactive contents from the environment for hundreds of years. They are generally low geometric mounds, sometimes as high as a hundred feet tall, covering a few acres or as much as a half mile, and composed of layers of engineered soil and gravels designed to shed rainwater and limit erosion, in order to take their contents, intact, away from the present and as far into the future as possible.

The contents are not considered high-level radioactive waste, like spent fuel from nuclear reactors. That material has yet to find a permanent home. What these cells contain is radioactive tailings from uranium processing sites, as well as the demolished buildings and apparatus from the mills themselves. The amount of radioactivity in these cells varies, but is generally considered harmful to people if exposure takes place over sustained periods. Most of the radiation comes from uranium 238, which has a half life of 4.47 billion years, nearly the age of the earth itself.

Sometimes the disposal cell is built at the site of a closed-down uranium mill, but in most cases the cell is constructed a few miles from the mill site, in a location that is more distant from communities and waterways, and the material is trucked to the site for burial.

Though anomalous and distinct in their form from their surroundings, the cells are meant to blend in geomorphologically, to integrate with the forces of drainage and erosion of the landscape. In arid environments, the outer shell is a layer of coarse riprap rock, golfball to softball sized stones a foot or two thick. Beneath this

The Lay of the Land

is a clayey soil layer, a few feet thick, which covers the radioactive material below. When rain falls, the water passes through the riprap, then flows over the top of the less permeable clay layer, and down the sides of the pile, where troughs and channels take it away from the structure. The riprap is a carapace, holding the clay beneath it in place, and it also reduces the collection of organic material on top of the mound and the development of soil that would lead to growth of plants whose roots could eventually penetrate the clay layer. The low angle of the sides of the mounds, less than the angle of repose, keep the rock in place, and the form of the mound intact.

In places with higher rainfall, the tops of the mounds are sometimes covered in soil, not riprap, and planted with grass. The soil and plants act as a sponge, soaking up the rain, and slowing down the runoff which would otherwise form channels, and eventually erode the clay barrier beneath. The soil and grass also reduce runoff by evaporating and transpiring moisture into the air. The shallow roots from the planted grass help keep the soil in place, while other plants that might sprout unintentionally, with potentially deeper roots, are extracted from the soil through regular maintenance of the pile.

The cells tend to be in arid regions in the southwest, as this is where the uranium was mined and milled: northwest New Mexico, western Colorado, and southeastern Utah, especially. But they were built elsewhere, too, as uranium mining and milling occurred in other states such as Texas, Washington, Oregon, and Wyoming. Uranium metal processing and engineering took place in dozens of states, including Massachusetts, New York, Pennsylvania, Missouri, West Virginia, and Ohio. In some cases factories involved in the process of milling uranium have been razed and transported across the country for disposal in arid land disposal cells. In other cases, the factory site was bulldozed into a mound, capped, and left for the future.

Many of the mills from the uranium boom years sat abandoned for decades, with the radioactive tailings and salvaged parts from the mill used as construction materials in the surrounding communities. In some places, the mounds of sandy-textured tailings were used to make concrete for sidewalks, patios, parking lots, houses, and even



The mound at Canonsburg, Pennsylvania, is covered in grass, and is located at the site of a former uranium ore processing facility.

CLUI photo





The disposal cell at Grand Junction, Colorado contains the remains of the Climax Mill, which was located on the Colorado River in the middle of Grand Junction, 18 miles north of where the cell was made. A section of the 94-acre cell was completed in 1994, but the rest of the cell remains open, as it continues to accept contaminated material from the 4,000 sites in the region that used the abandoned mill tailings as construction and fill material. CLUI photo

schools. These structures later had to be identified and torn down as part of the clean-up process, and the remains moved into these mounds.

Most of these piles were made by contractors for the Department of Energy in the late 1980s and early 1990s, when the government took over handling the wastes left by companies, in some cases bankrupted by the process, or otherwise no longer existing or accountable. The government was, after all, the reason these sites existed in the first place, since in the early years of the industry they were the only customer for uranium—using it to build atomic bombs.

Dozens of uranium mills were constructed in the 1940s and 1950s, dating back to the Manhattan Project, exclusively to supply the material for reactors used in weapons production, and in the weapons themselves. While the government-propelled uranium prospecting and mining boom ended in the 1960s, once supplies



This new disposal cell, north of Interstate 70 in eastern Utah, was constructed for uranium mill tailings and debris from a mill site in Moab, 30 miles south. Contaminated material started arriving in 2009 on a specially constructed railway, at the rate of around 5,000 tons per train. The total amount of material destined for the site is 16 million tons. When the site is complete (sometime after 2019) it will be a mile long, a half a mile wide, and 25 feet tall, with another 25 feet of material below grade. CLUI photo

for atomic weapons were met, some of these sites continued to operate for the atomic power industry, which uses uranium as fuel in nuclear reactors. A number of these uranium mills continued to operate until the 1990s. Today there are only a couple of active uranium mines in the nation, and only one active commercial uranium mill.

Disposal cell construction started in the late 1980s, and continues to this day. The original mill sites, as well as the disposal cells, are managed by the Department of Energy's Legacy Management Office, created in 2003 to care for these sites indefinitely into the future.

The office also takes on responsibility for long-term monitoring for some other uranium and non-uranium related contaminated sites around the country, those that had the federal government as a customer, after they get closed and cleaned up by the companies that owned and operated them. The Legacy Management Office currently manages more than 100 sites, a list that is growing. ♦

View a clickable map at [www.clui.org/page/radioactive-disposal-sites-usa](http://www.clui.org/page/radioactive-disposal-sites-usa)



Monument at the cell at Falls City, Texas, with the mound in the background.

CLUI photo

## URANIUM IN THE U.S.A.

### A QUICK LOOK AT THE INDUSTRY TODAY

FROM THE BEGINNING of the Atomic age until 1980, the USA was the largest producer of uranium. Naturally occurring U-238 is the building block of the industry. It is nearly everywhere in small quantities, on the order of three parts per million, on average, in all the material on the earth's crust (even the ocean), and higher in common rocks like granite, and soil. While it has a half-life that is nearly as long as the earth is old, it is not fissile, and its danger to humans comes more from the radon it produces as it decays, and from the other isotopes and elements produced from it by industrial processes, than the material itself.

Though the USA has some of the largest known high-grade deposits on earth, most of it is now imported, more inexpensively, from Australia, Canada and Russia. But that could be changing. At present, there are only a couple active uranium mines in the USA, but dozens are in standby mode, awaiting favorable



economic conditions, political will, and permitting. There is only one operating uranium mill and one fully operational enrichment plant, though another is under construction, and another is being planned.

The weapons industry has more than enough stockpiled, so the main demand for the material is for nuclear energy. There are 104 commercial nuclear reactors at 65 power plants around the nation, generating around 20% of the power consumed in the USA.



CLUI photo

## Mount Taylor Uranium Mine, NM

One of several major uranium mines sitting idle at the moment, the Mount Taylor Mine sits atop one of the largest uranium deposits in the country, in western New Mexico. It was first developed in 1986 by Chevron, and for three years extracted and shipped eight million pounds of ore to the company's Panna Maria uranium mill in southern Texas, before being placed on stand-by status in 1989. Like most uranium mines, this is an underground operation, with vertical shafts accessing the ore body, which is 3,000 feet beneath the surface. Efforts to reopen the mine are ongoing, and the site is staffed and maintained. It is now owned by Rio Grande Resources, a division of General Atomics. The company also acquired Chevron's south Texas mills and uranium operations.



CLUI photo

## White Mesa Uranium Mine, UT

The only conventional uranium mill currently operating in the USA is the White Mesa Mill, at Blanding, Utah. It is owned by the Energy Fuels corporation, a Canadian uranium company, which has proposed building a new uranium mill in the Paradox Valley of Colorado.



CLUI photo

## Paducah Gaseous Diffusion Plant, KY

Currently the only fully operational uranium enrichment plant in the United States, the Paducah Gaseous Diffusion Plant is a massive industrial site that produces uranium 235 for use in nuclear power plants and nuclear propulsion systems, such as submarines. The plant is owned by the Department of Energy, and operated by the United States Enrichment Company, with most of the operations actually run by the Lockheed Martin Company. 2,200 people are employed on a 3,423-acre site. Two other uranium enrichment plants in the United States, at Piketon, Ohio and Oak Ridge, Tennessee, ceased operations more than a decade ago. A new \$3 billion plant proposed by the French company Areva, to be built in Idaho, has been permitted but construction has not yet begun. And its partner company, Urenco, is currently building the National Enrichment Facility, in New Mexico.



CLUI photo

## The National Enrichment Facility, NM

A new uranium enrichment plant being built in the ranchlands near the town of Eunice, in the southeastern corner of New Mexico, the National Enrichment Facility is currently one of only two uranium enrichment plants in the nation (the other is the Paducah Plant). It is being built by Urenco, a European company that controls around a quarter of the world's uranium enrichment. The facility uses the more efficient centrifuge enrichment process, rather than the older gaseous diffusion method used at Paducah. One of the largest single industrial projects built in the USA in the last decade, the \$2 billion+ project broke ground in 2008, and was licensed to begin processing feed materials in June 2010, though most of the site is still under construction. If completed at the intended scale in the next few years, the facility would be capable of producing half the uranium fuel needed for the domestic nuclear power industry. ♦



## NUCLEAR FRACKING

AN IDEA WHOSE TIME HAS COME, AND GONE



New gas wells within three miles of the surface ground zero of the Rulison nuclear gas well fracturing test. CLUI photo

NO MATTER HOW much people fear and complain about the effects of fracking, it could be worse. In the 1960s and 1970s a number of private energy companies developed proposals to stimulate underground gas deposits using nuclear bombs. While this seems like a curious concept to consider, even more surprising is that three of these projects were approved, and ultimately succeeded.

The first one was conducted by the El Paso Natural Gas Company, working with the Lawrence Radiation Lab at the University of California, Berkeley. The gas company conceived of the project in 1958, and proposed it to the Atomic Energy Commission. The AEC adopted it as one of the signature projects for the Plowshare Program, exploring peaceful uses of nuclear explosives.

With a nuclear device, the explosive force of thousands of tons of TNT can fit in a few cubic feet, and easily be lowered to the bottom of a drilled hole. El Paso, one of the largest gas companies in the country, believed that such a dramatic increase in explosive force would open up natural gas sources all over the country that were not accessible under current, conventional explosive fracturing methods.

The project, code-named Gasbuggy, ended up taking nine years to develop, and it cost the company \$1.8 million to engineer it. 160 acres were secured in national forest grazing lands in northern New Mexico, at a known gas-rich area. The federal government paid another \$2.9 million, and supplied the nuclear device. A 19-inch wide hole, 4,420 feet deep, was drilled, into which the bomb was lowered. The hole was sealed, and the shot took place in 1967. The blast was equivalent to 29,000 tons of TNT, roughly twice the size of the Hiroshima bomb. It created a large central cavity, around 200 feet in diameter, that was expected to fill up with gas from cracks formed deep into the surrounding rock.

Gas wells were later drilled into the formation, and gas was processed at facilities on the surface, operated by the AEC and El Paso under special conditions, as it was known that the gas would be radioactive. It was also expected that after some period, the radioactivity would decrease, and the gas could be marketed. This did not occur, and after ten years of lower than anticipated amounts

of gas with higher than anticipated radioactivity, the project was shut down.

Irradiated production equipment, separation tanks, and soil was taken to the Nevada Test Site for disposal, and the wells were plugged. Gas, groundwater, and soil sampling continued until 2002, and final surface remediation was completed in 2004. Hydrologic monitoring will continue indefinitely. The site is marked with a small cement monument with a plaque that forbids excavations there. Cows wander around.



The monument at Gasbuggy. Gas in the region was and continues to be extracted by conventional means, staying clear of the old nuclear fracking site. In 2002 the El Paso Gas Company attempted to lease 40,000 acres in the National Forest for methane production. A law banning production in that part of the forest was passed to stop them in 2006. In 2011, the El Paso Corporation was purchased by Kinder Morgan, for \$38 billion. Kinder Morgan is now by far the largest energy logistics company in the country, with around 75,000 miles of pipe. CLUI photo

Rulison was the second of the three nuclear gas well stimulation projects. It was proposed and primarily financed by the Austral Oil Company of Houston, with the support of the engineering from CER Geonuclear, of Las Vegas (itself a joint venture between Continental Oil and EG&G, the primary contractor at the Nevada Test Site). Los Alamos National Lab supplied technical support and the nuclear device.

The site selected for the project was on the slopes of Battlement Mesa, in northwestern Colorado, a remote but known gas field. Drilled from an elevation of 8,145 feet, the hole extended below sea level, to a distance of 8,426 feet below the surface. The 40-kiloton bomb, in a package nine inches wide and 15 feet long was slowly lowered into position, and the hole filled with gravel and other stemming materials, with wires extending out the hole connecting the bomb to a control trailer 2.5 miles away. 37 families were evacuated from homes within a five-mile radius.

After several postponements, waiting for the winds to be blowing away from nearby population centers in case of any accidental venting, the detonation took place on September 10, 1969.

A few protesters were discovered within the evacuation zone, hoping their presence would further delay the test. Two were removed by an Air Force helicopter, at gunpoint. Two others were seen, but could not be captured due to the steepness of the slope, so were left there, two miles from ground zero. The two cleared an area of loose stones, and lay down on the ground, listening to the countdown, which was broadcast on a local radio station. At





Surface ground zero for the Rulison shot.

CLUI photo

zero, their bodies bounced eight inches into the air, but they were unharmed.

Brick chimneys in town, seven miles away, fell down. The rumbling of rockslides along the escarpment of the mesa continued for more than half a minute after the blast. The site remained sealed for six months to allow radiation and pressure levels to decrease. Drilling back into the blast chamber determined that it was around 350 feet high and 75 feet across, and was full of gas. Production testing lasted for around six months, but radiation levels were high enough that the gas was not marketable.

Operations ceased in 1972 after more than \$10 million was spent on the project. Radioactive equipment and soil was sent to a burial site in Beatty, Nevada. Wells were plugged in 1976, remaining equipment was removed and a monument was placed at the site. The owner of the property, a potato farmer named Claude Hayward, who allowed the AEC to conduct the project on his land, never saw a dime of the gas royalties he was promised.

Since then, gas production in the area has increased dramatically, due to advances in hydrological fracking. There are more than a dozen wells within the three mile buffer zone around ground zero. Several of them are along a well access road that wraps around the back of the site, where the closest drill pad is exactly a half mile from ground zero. A number of companies would like to drill closer, but so far this half-mile limit has been established, and is yet to be breached.

It seems unlikely that the Energy Department's ban on drilling deeper than 6,000 feet within the 40-acre surface area around the emplacement well will be challenged.

Despite the poor results of these two first nuclear fracking projects, a third was planned and completed, less than 50 miles away. This one was conceived in 1970, and was conducted primarily by CER Geonuclear Corporation, which paid 85% of the \$9 million cost, in partnership with the Conoco Oil Company and the Lawrence Radiation Lab.

Unlike the other two, this shot used three nuclear bombs in the shaft, spaced a few hundred feet apart, more than a mile in the ground. The devices, each with a yield of 33 kilotons, were to be triggered simultaneously, in order to create a fractured area more

than three times as large as with a single device, as the rubble cavities were expected to collapse into one another.

The blast took place on May 17, 1973. 50 people from a 7.5 mile area were evacuated. Ground movement was felt as much as 50 miles away and at least one building in Meeker, 30 miles away, was damaged. Though the cumulative yield was close to 100 kilotons the chambers did not join as expected.

Testing of the gas extracted from the site continued for two years, but production quantities were less than expected, and radioactivity was high. The operation ceased and most of the site was remediated in 1976. The 320-acre parcel of government property is next to a dirt road and a creek, and is unfenced. A small cement monument and brass plaque, in the same form as at Rulison, marks the site. There are several test and monitoring well heads in the area.



Well head at the Rio Blanco site today.

CLUI photo

In 1974, as a result of Rulison and Rio Blanco, Colorado passed a state law requiring a public vote before another nuclear bomb could be detonated in the state. The next year, the Atomic Energy Commissions Project Plowshare was cancelled, after 27 separate projects. Rio Blanco's nuclear fracking blast was the last time a full-scale nuclear bomb would be used for peaceful, economic purposes. It was also the last time the U.S. nuclear program would detonate a nuclear bomb outside of the Nevada Test Site. ♦



Monument at the surface ground zero, Rio Blanco.

CLUI photo



## NEW JERSEY MEADOWLANDS

CLUI PUBLISHES MAP OF THE UNMAPPABLE



The Center's Meadowlands map is usually available to the public free of charge in the brochure racks at the Vince Lombardi Service Area, on the New Jersey Turnpike. Otherwise it can be purchased at some retailers in New York City, and through the Center's website.

CLUI photo

THE CLUI PUBLISHED a map of New Jersey's Meadowlands, as part of our ongoing efforts to find meaning and significance in this remarkable landscape, America's ultimate urban antipode. The map locates and identifies more than 75 selected points of interest in the region that reflect the dominant land uses there. These include logistics and transportation sites (such as airports, truck yards, rail yards), waste management sites (industrial clean-up projects, landfills), communication sites (data centers, radio transmitters), cultural sites (local museums, displays, memorials), and selected businesses and industries. The project is the culmination of several years of research and photography in the Meadowlands, that included field trips with students, excursions in canoes and powerboats, bicycle trips, hikes, train rides, and 4x4 adventures.

Though the project is available online, with a clickable, scalable map, the Center still believes that physical, paper maps have a function in these digital times. Paper maps can be used more easily in the field, where internet connections can be spotty and distracting. A map is safer and easier to manipulate and consult while driving, and the option of adding geographic annotations on it makes it useful as a recording tool, as well as a navigating tool.

The publication of the map was announced and celebrated in August 2012 at a public presentation about the Meadowlands by CLUI director Matthew Coolidge, in New York City, delivered to a packed house at Studio-X, the lower Manhattan outpost of Columbia University's Graduate School of Architecture, Preservation, and Planning. The presentation was in the form of a digital slideshow, 80 minutes long, with a constant, subjective, and interpretive narration. Copies of the map were distributed for free at the event. On the following day, a group headed out for an urban safari, field test and ground truthing of the map, in a rented passenger van.

*View a clickable map of Points of Interest in the Meadowlands at [www.clui.org/content/points-interest-meadowlands](http://www.clui.org/content/points-interest-meadowlands)*

## NEW JERSEY MEADOWLANDS

A TOUR OF THE TOUR



The chaotic swirl of roads, dumps, distribution centers, radio towers, and marsh that make up the Meadowlands.

CLUI photo

GETTING TO THE Meadowlands is easy. You can go by train from New York City to Secaucus Junction, one stop away from Penn Station, and you are in the middle of the Meadowlands. Or you can drive there on the Interstate from anywhere on the continent, ending up on the northern part of Interstate 95, the New Jersey Turnpike, which runs through the heart of the Meadowlands. Or you can fly there from anywhere in the world, landing immediately in the Meadowlands.

### Arrival:

#### Newark Airport

Let's begin at Newark Airport. If you are flying in, and the winds are from the south, you will have a map-like view of the Meadowlands as you descend. If you get to the airport by train from New York, you get a great ground view, passing many of the landmarks and back-spaces on the way. Come by car, and you get the view from the turnpike. Each of these serves as an introductory overview of sorts.

No matter how you get to Newark Airport, it's likely you will end up on the AirTrain, a link between the ground and the sky. It's an elevated monorail, like at the Getty Center or Disneyland. Futuristic, unpiloted, and automatic, it loops around and around, whether you are there or not. Like a flux, it does nothing but connect: air terminals, rental cars, long-term parking lots, and the train station.

The AirTrain interfaces with the carscape at a multitude of parking garages and rental car agencies, from which you can make an escape from the airport, that great beast of conveyance, through its intestines and service arteries, out of this urban digestive tract of arrival and departure, this multilayered system of modes, out of its orifice and orbit, on to the open road.

Of course the Turnpike is not always liberating, but it can be. Like most things, any fear or anxiety about it can be addressed through familiarity and repetition. The Turnpike travels the length of



## MEADOWLANDS

the Meadowlands and provides elevated views throughout. Even better, the Turnpike splits in two in the Meadowlands. One route stays on the western edge, another goes up the eastern side, then they both reconnect at the other end. This makes it possible to do a loop around the Meadowlands, around and around, until you get used to it. All the while you will see the landmarks go by, and get to know them.

Consider the first toll booth you hit after the airport as the starting gate for this looping turnpike track. Heading north, on the western spur, you pass under the Pulaski Skyway, then over the Passaic River, past landfills 1D, 1A, and 15W (named after their Turnpike exit number), then through Saw Mill Marsh, past the Meadowlands Commission Headquarters, past the Harman Cove Towers, over Berry's Creek, through the sports complex, the Empire Tract, then over the Hackensack River—all within a few minutes, if you're lucky. Exit at the Vince Lombardi Service Area, and you can make a pit stop before heading on the south-bound part of your turnpike loop. The plaza has Nathans, TCBY, and free brochures.

On your way out, look for the Turnpike South signs for the eastern spur (Exits 18, 16, and 15X). On this side you'll pass by the clothing warehouses and data centers of North Bergen, through the office plazas of Secaucus, and past the Alexander Hamilton Service Area, named after the founding father who was shot in a duel that took place over the hill in Weehawken. The Turnpike passes Secaucus Junction Station nearly close enough to touch it, and what's left of Laurel Hill, then flies over the Hackensack, with tremendous views, then joins its western spur for the trip over the Passaic, and under the Pulaski, after which you can get off at Exit 15, pay the toll, and start the loop over again, heading north, under the Pulaski and over the Passaic ...

Once you feel you are acclimated, oriented, and ready to enter the Meadowlands at street level, you can begin, as we often do, at the top, and work your way down to the bottom. To do this, go one exit past the Vince Lombardi Service Area, to Highway 46 westbound, which becomes Sylvan Avenue in Little Ferry, a classic New Jersey car strip, built on filled-in swamp.

### **Headwaters: Airports, Office Parks, Contamination, Restoration**



Highway 46 at Little Ferry, New Jersey, the top of the Meadowlands. CLUI photo

Highway 46 leads to Teterboro Airport, at the northwest corner of the Meadowlands. The Meadowlands are anchored by two airports, Teterboro at the top, and Newark at the bottom, both built on filled-in swamp, like many airports. Teterboro is one of the busiest small jet airports in the nation, serving corporate jet activity for the NYC and northern NJ region. Sony Aviation, for example, has a hangar and aircraft fleet for celebrities and VIPs, with limos waiting to take them into New York City. Dassault Falcon, the French business jet company, has its main business office for the Americas here.

At a dead end past the control tower is a regional aviation museum, with a number of interesting avian specimens, like fragments of the Hindenberg, which burned at New Jersey's Lakehurst Navy Base in 1937, ending the use of blimps as passenger vessels. The museum has an array of unusual small aircraft including the Glidemobile, an early hovercraft test flown on a New Jersey pond in 1959, and a flight simulator used to train pilots in the dawn of the jet age.

There are displays about Newark International, the Meadowlands' other airport, which was the first major airport built in the New York City area. In 1935 Amelia Earhart was on hand for the opening of the nation's first commercial airline terminal there, and it was the busiest airport in the world at the time. In the 1970s it was expanded into its current form with circular terminal hubs, and it now handles 33 million passengers a year, more than La Guardia, but less than JFK. United Flight 93 took off from Newark on September 11, 2001, crashing into a field in Pennsylvania two hours later.

On the other side of Teterboro Airport is the former Bendix plant where things like flight control systems for military aircraft were made for half a century. It was bought by Honeywell in 1983, and was closed in 2008, when the work was moved to Albuquerque, and the building was recently demolished. All that is left of the legacy of Bendix is the Bendix Diner, across from the airport, at the corner of Highways 17 and 47. This intersection makes for another good place to pause, poised at the northwest corner of the Meadowlands.

Heading south on Highway 17 from the Bendix Diner you are on the road that defines the western edge of the Meadowlands. Residential hills on the right side and industrial flats on the left. Though it is filling in with contemporary national chain retail and restaurants, part of the great "Bed Bath & Beyonding" of the area's suburbs, the old corridor still has vestiges of character from earlier times, like the Fiesta restaurant and event space, full of colored fountains, and a favored prom party and wedding banquet location since the 1960s.

A more recent and austere addition to Highway 17 is the Federal Reserve Bank of New York's East Rutherford Operations Center, the main electronic processing center for the busiest district of the Federal Reserve. It was built to process all the checks used in transactions in New York and northern New Jersey, which annually numbered more than one billion checks, valued at hundreds of billions of dollars. The security around it is understandable, given that it can hold as much as \$60 billion in cash in its vaults.



## MEADOWLANDS

Nearby, Berry's Creek, a drainage artery of the northern Meadowlands, flows south out of its headwaters, the runways of Teterboro Airport, and into an industrial area south of Moonachie Avenue. A chemical processing site in the industrial area dumped hundreds of tons of mercury-contaminated wastes onto the ground and into the creek, over the years. Called the Ventron/Velsicol site, it is owned by Morton International, the same company that built space shuttle boosters, and sells consumer salt. It is one of dozens of contaminated industrial sites laying fallow in the Meadowlands.

Nearby, the Universal Oil Products Superfund site consists mostly of fenced mounds of earth, next to a new Fairfield Inn. It was the site of a chemical plant that over the years drained millions of gallons of waste solvents into unlined ponds, which then leached into the underlying swamp. The site, on the Superfund list since 1983, is still being addressed.

Orphaned and without personnel on site, a number of former industrial sites in the region are suspended in a bureaucratic and litigious limbo, without anyone wanting to pay bills and claim liability, so they just sit there, and become a new kind of forbidden public space, post-industrial funhouses for marginal and illicit activities of both a creative and destructive nature. They become part of the community in ways that cannot be designed, or officially recognized.

Many other interesting active businesses are located in the industrial park area between Teterboro, East Rutherford, and Moonachie, on filled-in Meadowlands drained by Berry's Creek, including the world headquarters for the Pantone Company. This is the company that manages color standards for the graphics, printing, and other color critical industries worldwide, a veritable ground zero for color. Macy's department store built a facility nearby for their Thanksgiving Day Parade floats. The floats have been stored and serviced in the Meadowlands for decades, lore referenced in Woody Allen's film *Broadway Danny Rose*.

At the end of the road in the office park are the gates of the Bergen County Utilities Authority's water treatment plant, one of the larger wastewater plants discharging into the Meadowlands. When overloaded, it sometimes ships sewage by barge to a treatment plant in Newark. South of the plant is a construction entrance to the Kane Mitigation Bank, a major marsh restoration project on the Meadowlands. The 240-acre site is owned by the Meadowlands Conservation Trust, and is being turned back into estuary. This is done by erasing the linear canals built a hundred years ago to drain the marsh, replacing them with a network of small meandering channels that allow tidal water from the Hackensack to penetrate the marsh. A major part of marsh restoration involves clearing out the invasive, non-indigenous phragmites that took over the Meadowlands, killing native vegetation, and clogging up flow. The project is being financed as a mitigation bank, meaning regional transit authorities (road and rail) that build projects in the swamps have to also pay for restoration efforts here. This land is part of what was formerly known as the Empire Tract, over 500 acres left undeveloped as part of an exchange that allowed the Xanadu entertainment complex to be constructed nearby. Fundamentally, it's a massive reengineering project to create a landscape that functions, as much as is possible, like we were never here.

### Recreationscape: Megacomplexes, Abandoned Driving Range



The unfinished Xanadu is now the American Dream: Meadowlands, and still destined to become the largest shopping center in the world. CLUI photo

On the other side of Walden Swamp is the Meadowlands Arena and Sports Complex, what most people think of when they think of the Meadowlands.

The sports complex was an early development project by the Hackensack Meadowlands Development Commission. It is a cluster of a half dozen megastructures, surrounded by an ocean of parking lots.

The complex is dominated by the new Meadowlands Stadium, also called the MetLife Stadium, since the insurance company bought the naming rights for it. It is the home field for the NY Giants and NY Jets football teams, who sometimes play each other here, an unusual rivalry on shared home turf. The stadium cost \$1.6 billion, and opened in 2011. In 2009, the 33-year old former Meadowlands stadium was demolished, following a closing concert by Bruce Springsteen. It was located next to the new stadium site, so as the old one was torn down, the other was being built. The debris from the old stadium filled its own hole, and is now covered over by the parking lot.

Next to the new Meadowlands stadium is the Meadowlands Racetrack, a horse track built around the time of the first stadium. Like people at the track, the track itself has been losing money for years. The state has considered casinos, NASCAR, and other enhancements for it. The lake in the middle of the track was built to resemble the shape of the state of New Jersey, though this can only barely be discerned from the stands.

Another large facility at the sports complex is the Timex Performance Center, which is used as the practice facility for the NY Giants football team. They train on three and a half football fields outside, and one under the big shed roof. Next to it is the water park, once used for boat races and waterskiing events, but now hardly used at all. The Izod Center holds around 20,000 people, and was built in 1981 originally as a basketball stadium and a hockey rink for professional teams. All of these teams now play elsewhere, and the arena is used just occasionally for rock



## MEADOWLANDS

concerts. Called the Continental Airlines Arena before the pro sports teams moved away, the clothing company Izod pays around a million dollars a year for the naming rights.

Next to Izod is the latest and largest Meadowlands attraction, which has been under construction for nearly a decade. Called Xanadu, it was to be the largest entertainment, sports, and retail complex in the country. Ground was broken for the project in 2004. In 2009, with about 80% of it complete, and nearly \$2 billion spent, financing fell apart, and construction was halted.

The unfinished complex is topped by what was to be the nation's only indoor ski slope. Other features were to include a 26 screen movie theater, bumpercars, laser tag, a giant Best Buy, Cabellas, a Virgin megastore, and a 300-foot tall Pepsi logo-emblazoned Ferris wheel next to the turnpike. For two years the 2.5 million square foot building was quiet, and began to decompose. It was scorned as one the nation's largest retail failures, and called "the ugliest building in America" by the governor of New Jersey.

But the project was too big to fail, and a new team and concept is at work on it again, by the group that built the Mall of America in Minneapolis (the largest mall in the USA) and the Edmonton Mall (the largest mall in North America). The new plan, announced in mid 2011, would make this the largest mall in the world, with 7.5 million square feet of retail space. The new name: American Dream Meadowlands.

Patterson Plank Road goes over the turnpike on a bridge, heading from Xanadu to an interesting area of relics on the Hackensack River. The road's name comes from the fact that it once connected Patterson New Jersey to Jersey City—an early diagonal thoroughfare through the Meadowlands, partially made of wooden planks laid out on the swamp.

The old roadbed up to the water's edge is still visible. It follows electric lines across an abandoned driving range to the base of a bridge that is no longer there. The bridge connected to Secaucus, on the other side of the river, but was torn down after Route 3 was built in the 1930s. Before the bridge, ferries would take people across the Hackensack here.

The driving range was abandoned after a storm a few years ago, though the owners have since used it as a paintball park, and some colorful splatters are washing away. It is next to the Dragonfly Bar and Grill, the only active business left at this old marina area. Two small private boat clubs, the Snipe and the Majestic, still occupy the site, with a few recreational boat hulks in and on the shore.

This old marina area, a rare remnant of old Hackensack River life, is almost gone. The old barge landing is bargeless, and as of 2012 is River Barge Park and Marina, operated by the New Jersey Meadowlands District Commission, a site where people can take official eco-tours on the Hackensack on the Commission's fleet of pontoon boats, and read historic plaques that talk about what was there. Meanwhile, the abandoned home of the Steiner family, who owned the property until the 1970s, is collapsing in the bushes under the shadow of the pleasure dome of the American Dream Meadowlands.

This is a dead end. To return to the Meadowlands, you have to head back over the bridge over the Turnpike. Head east past Xanadu, and onto Route 3, and in minutes you'll be back on the west side of the Meadowlands, and into the next zone.

### West Side:

#### Dumps, Graves, Communication, Interpretation



The Meadowlands Museum is a local history museum with some surprising features. CLUI photo

Route 3 is the principal east/west highway cutting across the Meadowlands, connecting Secaucus in the east to Rutherford in the west. At the west side of the sports complex, Route 3 passes over Berry's Creek, at the point that the natural drainage channel through the swamp meets the canal dug by the Erie Railway Company a hundred years ago. The canal helped industries develop upstream which would later pollute the creek to the point that fish cannot survive in it.

Near the intersection of Route 3 and Route 17, the road that travels along the base of the hills on the west side of the Meadowlands, is the Meadowlands Museum, housed in one of the area's oldest homes. It is a local history museum full of information about the region's recent past. Upstairs the walls have been painted with displays about local minerals, natural history, and the more distant past. Coincidentally, this house was once the home of Charles Smithson, an ornamental concrete sculptor and plasterer who worked on the subway stations of New York City, and who was the grandfather of the artist Robert Smithson. Robert Smithson was a pioneering conceptualist and land artist who grew up nearby, and who wrote the essay *Tours of the Monuments of the Passaic*, and made *Spiral Jetty* in the Great Salt Lake. He is buried in Hillside Cemetery, across Route 3 from the Meadowlands Museum. His grave overlooks the Meadowlands.

Medieval Times, a themed entertainment and dining establishment, is located at the base of the cemetery. It's an anachronism in a warehouse, and one of several interesting businesses in the Meadowlands Corporate Center, an office park at the base of the hills here. The Sika Corporation, a Swiss chemical conglomerate, makes plastic sealants at a plant on Polito Avenue, next to Medieval Times.



## MEADOWLANDS

Across from Sika is the antenna field for WINS, an AM talk radio station, one of more than a dozen radio transmission tower sites in the Meadowlands. Radio stations use the undeveloped marshy areas as it is otherwise economically unproductive land, and because it is open, so radiowaves can radiate unobstructed in the direction of their main audience. Also, radio ground waves propagate well over brackish water, especially AM. Thus the swamps of the Meadowlands are the origin for the talk radio of the New York region.

Past the warehouses along Valley Brook Avenue in Rutherford is the northern gateway to the land of landfills, an area of terrestrial transformation, interpretation, and remediation on a large scale. For over a hundred years dumping took place all over the Meadowlands, in part to fill them in so they could be built on, but also as the expansive urban area needed a place to put its wastes. The Hackensack Meadowlands Development Commission was established in 1969 to control the filling of the swamps and to deal with the unsanctioned landfills, some of which were visibly smoldering along the New Jersey Turnpike.

Now called the New Jersey Meadowlands Commission, it is a regulatory agency that controls environmental projects, landfill closure, and redevelopment over 30.4 square-miles, most of the partially or minimally filled-in Meadowlands swamps, and all of its landfills. The area along Valley Brook Avenue, much of which is former dumps, has been slated for redevelopment on a large scale. The EnCap development proposal, which involved a golf course, hotels, townhouses, and retail, was to cover 800 acres here. After nearly ten years and \$300 million in planning and site work, the project went bankrupt a few years ago.

The headquarters of the Meadowlands Commission is past the EnCap site, at the end of Valley Brook Avenue, where the street name changes to Disposal Road. The main building has administrative offices for the Commission, as well as some displays and a gift shop. The former and notable “garbage museum” on display here in the early 1990s, has been replaced by an educational center for teaching school kids about natural science and ecology. A promontory extending from the building out over the water enables visitors to feel more immersed in the marsh. At the end of the walkway is the Marsh View Pavillion, surrounded by canted plaques providing interpretive captions for the views of the marsh and the landfills.

The Commission headquarters is located on the Kingsland Impoundment, a 90-acre bermed enclosure in the swamp, filled mostly with open water. The Impoundment was slated to become a landfill in the 1970s, but was instead purchased to be the agency’s headquarters and a natural preserve. It is now part of Richard W. DeKorte Park, which has a number of trails and viewing areas around the impoundment. Interpretive devices such as viewing tubes and descriptive plaques are in abundance in the park. The Transco Trail is a mile-long nature trail on a berm covering the three-foot diameter Transco gas pipeline, which runs inches below the surface, and brings natural gas from the Gulf of Mexico to the northeastern U.S.

The Amvets Carillion is one of a few memorials in the park. It was made in 2007 and its bells chime daily. Nearby, a 9-11 memorial

faces the distant view of the Manhattan skyline, and has twin tower-like piers that are roped off. Next to the piers is an overlook where you can stand in footprints painted on the ground, to line up a steel silhouette of a skyline which has the twin towers on it, which overlaps with the actual skyline in the distance—which does not.

The Meadowlands Commission office is located at the foot of the Kingsland Landfill. The Bergen County Utility Authority operated the site as a municipal landfill for the region for decades. It was being remediated as part of the failed EnCap project, and was supposed to be part of the golf course. Disposal Road continues south along the base of the Kingsland Landfill, past landfill gas collection points, where the methane from the landfill is burned to produce electricity.

The road leads to an abandoned baler facility once operated by Bergen County at the former entrance to the Kingsland and Erie Landfills. The Meadowlands Commission helped pioneer a number of aspects of landfill management, including techniques for compressing the incoming garbage so that it could be more easily transported, and so it would take up less space in the landfill. Trash would come first to large sheds next to the landfill where it would be compacted by hydraulic compressors into squares, roughly a cubic yard in size, weighing around 3,000 pounds each. These bales would be loaded onto trucks, and stacked in the landfill with front loaders. This system was abandoned here when these landfills were closed. The county baler building is abandoned and overgrown—the trash buildings themselves have become trash.

The original Commission building which housed the largest waste baling machines in the nation is located a mile south of the Bergen County facility, next to the Saw Mill Landfill in North Arlington. It is still being used to handle trash, though in the usual way, dump and load. The Saw Mill Landfill, known in Commission terminology as Landfill 1E, and locally as Mount Arlington, is one of the largest landfills in the Meadowlands. It is a consolidation of adjacent landfills: Landfill 1C, a 212-acre mound operated by the town of Kearny; and North Arlington’s 195-acre Balefill Landfill (so named as it was full of bales from the baler). As one of the tallest hills of the Meadowlands, it has a panoramic view of the landscape north, south, and east; across the Saw Mill Marsh, the New Jersey Turnpike, Jersey City, Secaucus, and Manhattan.

### Kearny:

#### Turnpikes, Tracks, Ponds, Trucks



The underside of the New Jersey Turnpike in Kearny.

CLUI photo



## MEADOWLANDS

Kearny is the town at the bottom of the Meadowlands. Its ten square miles span from the Passaic River in the west to the Hackensack in the east, and covers their confluence at Newark Bay. Most of its population of 40,000 live on the hills to the west, above the Meadowlands. An equally large area is the industrial peninsula of South Kearny, at the confluence of the rivers, intensely developed, but with no housing. Between them is a chaotic labyrinth of lines of conveyance and terminal eddies, landfills, and impoundments in the swamp.

The Belleville Turnpike is one of the great roads of the Meadowlands. Hardly anything like the New Jersey Turnpike, it is an old two-lane surface road that runs diagonally across the southern Meadowlands, connecting to the Newark Turnpike. Belleville Turnpike was macadamized in 1914, but dates back to 1765, when it was used to carry copper from the Schuyler mines, one of the nation's earliest copper sources, located in what is now the residential part of North Arlington, on the edge of Kearny. Though long since closed and built over, the old underground mining area is full of caverns and shafts, just below the surface. In 1989, some of these cavities collapsed into sinkholes, damaging the Schuyler condominiums, on Schuyler Avenue. Secret entrances to the mines are on the slopes north of the Belleville Turnpike.

The Turnpike leaves the hilltop grid of the residential area through the cemetery, and enters the flats next to the base of Mount Arlington (Landfill 1E), across from the Jeryl Industrial Park. This industrial area has had its share of contaminated brownfields, and is also prone to flooding. South of the industrial park is Kearny Marsh, a freshwater marsh that is contained within a 310-acre impoundment of roads and railbeds. The Keegan Landfill, one of the few active landfills left in the Meadowlands, leaks leachate into the water, adding to the already high levels of contaminants in the landlocked marsh. South of Kearny Marsh is the southwest corner of the Meadowlands, on the north side of the Passaic River, with Landfill 1D, and 15W, named after the adjacent turnpike exit. Here, too, you will find Walmart, postal processing centers, and scrap yards filling in the triangular voids in-between things.

This stretch of the Passaic is called the Harrison Reach, and it is often cited as the most contaminated stretch of river in the nation. Industries along the banks include the former Diamond Alkali Plant, which made DDT in the 1950s and Agent Orange in the 1970s. It is now owned by Occidental Chemical of Los Angeles, and has been partially remediated. Some of the wastes at the facility have been covered by a berm, but the sediments of the river have hardly been addressed. The river here flows under the New Jersey Turnpike, and rounds its final bend in South Kearny, across from a peninsula named Point No Point.

The Belleville Turnpike continues its cross-section through the swamps, the roadbed creating more incidental impoundment along with the other random criss-crossing trajectories of pipelines, rail lines, roadways, landfills, on-ramps, and berms. Each pond between these lines is its own anonymous ecotonic soup. The turnpike passes more radio transmitters, blasting scratchy AM hysteria invisibly through and over the land. Some of these transmitting stations are abandoned and used as squats for swamp rats, human and not.

Nearing its southern end, the turnpike passes Landfill 1A, the first Commission landfill to be closed in a modern way. Closure here

used technologies which are now commonplace, such as digging a deep channel around the entire base of the landfill to isolate it from surrounding groundwater, and pumping the collected leachate out through a series of wells, sending it by pipeline to the local sewage treatment plant. Other innovations at this landfill include building a pond on top of it, a pond that has since collapsed, as the landfill has settled considerably over the past thirty years.

The Commission worked with artist Nancy Holt to turn the landfill into a sculpture and celestial observatory, called *Sky Mound*. She spent years on the project, though only a few of her ideas were implemented. It is unknown if the public would have ever been able to visit the *Sky Mound* earthwork and taken in its views directly, or if they would have just enjoyed what they could see of it—such as the planned methane flares—from the turnpike.

Across the Belleville pike from Landfill 1A, next to the towers of WMCA, Christian talk radio, is a road that heads out behind Royale Linens, to a network of linear berms with interesting landmarks and overlooks. The main road ends where the Portal rail bridge for active NJ Transit and AMTRAK lines cross the Hackensack River. North, a road continues on an undulating paved berm along the river's edge, and leads to an underlook of the New Jersey Turnpike and onward to the rotating Conrail Swing Bridge, on a line taken out of service in 2003. On the other side of the bridge is Laurel Hill Park in Secaucus, one of the few public boat launches in the Meadowlands.

South of the Royale Linens road is an underpass that serves as the northern gateway to one of the largest, and most complex contaminated brownfields in the Meadowlands. The property is generally referred to as the Koppers Coke Site, as much of it was a coke plant operated by the Koppers company from 1917 to 1979. Most of the buildings, including a coal tar processing plant and storage facilities, have been removed, and the landscape is being remediated. The northern part is the former Diamond Shamrock chromate chemical plant, a 30-acre industrial site that operated from 1916 to 1976. It is owned by Tierra Solutions, a corporate entity derived from its successors, Diamond Shamrock and Occidental Chemical.

Another part of the property, located in the middle, operated until more recently, and still has buildings and many contamination issues yet to address. Known as the Standard Chlorine site, it operated from 1916 to 1993, producing chemicals such as drain cleaning products and mothballs. Contaminants on-site include hexavalent chromium, dioxin, chlorobenzene, and naphthalene. It was put on the federal Superfund list in 2003. The former distillation tower is a landmark on the Hackensack.

The Koppers Coke site is one of the largest redevelopable heavy industry sites in the region, and many interests are at work planning its future. Among the problems at the site, though, is its abrupt proximity to the fast-moving traffic along the Belleville Turnpike. Currently the main entrance is on its eastern end, where the county's Improvement Authority controls access. Earthmoving has been going on at the site for years, using a barge loading site on the east end to move larger quantities of clean material to the site and contaminated materials from it.



## MEADOWLANDS

Much of the work is being done by the Severson company, an environmental services company at work on over a hundred superfund sites around the country. Severson was the principal contractor for cleaning up Love Canal at Niagara Falls, where the company is still based. The Clean Earth Company, a hazardous soil handling company, also works at the site. An Owens Corning asphalt roofing shingle plant is adjacent to the Koppers Coke site, a still active remnant of the local former industries of coal, coke and tar.

The Koppers Coke site is at the northeast corner of the peninsula of South Kearny, an industrialized fulcrum between Jersey City and Newark, a long-ago paved over marsh at the confluence of the Hackensack and Passaic. The peninsula is separated from the more open lands of the Meadowlands to the north by railyards that span the peninsula from the Hackensack to the Passaic, centered around the Meadowland Maintenance Center, a repair facility for NJ Transit. The rail company CSX also operates at the site, an intermodal yard moving goods between truck and rail.

The Belleville Turnpike ends here and merges with the Newark Turnpike, which heads eastward over the Hackensack, out of Kearny, merging with the mess of transit. A careful meander around these fast-moving pikes onto Fish House Road, and into the South Kearny Peninsula.

You'll first pass the Kearny Generating station, a power plant that resembles a gothic cathedral looming over the Hackensack. Thomas Edison was on hand for its opening in 1925, and since then it has been updated several times, most recently in 2001. The four current units at the plant now all burn natural gas, and generate up to 500 megawatts of electricity for the region.

In the middle of the peninsula is the Skyway Diner, a favored stop for fans of the TV show *The Sopranos*, who come on guided tour buses to see this icon of an Italian American mob sort of place. It was used as a location for at least one shooting scene in the series. The Skyway Diner sits under the Pulaski Skyway, which soars over South Kearny, with one exit along its 3.5 mile path—a narrow ramp dropping into South Kearny. Built in the 1930s, the massive steel overpass flies over the peninsula like a giant steel blimp.

Trucking dominates the South Kearny peninsula like nowhere else. The Highway 1 and 9 Truck Route was built in the 1950s to take truck traffic off the narrow and structurally limited Pulaski Skyway, and encouraged the development of South Kearny as one of the major truck logistics sites in the nation.

South Kearny was home to Western Electric, whose plant here was a major manufacturer of electronic components for the Bell Telephone system, operating from 1926 to 1986 and employing thousands. The building is still there, but is now leased space used for trucking and storage. North of it, along the Passaic River, is the former Syncon Resin plant, a contaminated industrial site awaiting treatment. Part of the site is used by the Clean Earth Company as a hazardous waste handling facility for regional projects.

The largest site in South Kearny is the former Federal Ship Building yard, which dominates the southeast side of the peninsula. It was started by a U.S. Steel subsidiary in 1917 to build ships for WWI.

In WWII it built destroyers and other ships, and employed 32,000 people. The yard became a shipbreaking facility in the 1970s, taking apart battleships, cruisers, destroyers, and aircraft carriers. The site is now the River Terminal distribution facility, with 5.5 million square feet inside, and 300 acres outside, but it makes no use of its waterfront location. Most of the shipways have been filled in. It's just warehouse space accessed by trucks.

The very tip of the peninsula is a no man's land, divided in half. The east side, on the Hackensack, has a former waste treatment plant, with some intermodal rail shipping yards and overgrowth. The west side, on the Passaic, is a former industrial site that is being remediated, and is also off-limits. South of the tip is Newark Bay, no longer the Meadowlands.

### Secaucus:

#### The Jewel of the Meadowlands



Welcome to Secaucus.

CLUI photo

Situated between the base of the Bergen Hills to the east and the Hackensack River to the west, Secaucus is the heart of the Meadowlands. The community is surrounded completely by the Meadowlands, and is therefore in and of the swamp, whether it looks like swamp anymore or not. Like Kearny, the town is divided distinctly into a residential part and an industrial part. The town's 17,000 residents live in a cluster at the northern end, and an office park area covers the southern end. Then there are green holes where the swamp dominates still.

Numerous rail lines and roadways converge at the base of the hills at the southern tip of Secaucus, entering tunnels and roadcuts heading towards tunnels under the Hudson. It's as if nearly all the linear elements of the southern Meadowlands emanate or converge from this place. And it's usually under construction, being completely rejiggered, at a cost of hundreds of millions. If you can find your way out of the mess, off highway 1-9, go north on County Road, the southern gateway into Secaucus.

On one side is the Croxton railyards, on the other a massive postal processing center, one of three in the Meadowlands. This one handles most of the bulk mail for the New York City area. This is where your junk mail comes from. County road crosses the town line into Secaucus unmarked, near an anomalous old brick farmhouse. Secaucus was famous for its pig farms. In the old days much of the food wastes from New York City restaurants and



## MEADOWLANDS

grocery stores would find its way to the farms over here on the edge of the swamps, like this one. Due to the proximity of area industries, even this hemmed-in farmstead has its soil contamination issues, running down Penhorn Creek.

Across the tracks from the old farmstead is the Secaucus Junction rail station, a key in the effort to create a transportation hub in Secaucus. A veritable temple of transportation, the station is still considerably larger than its usage demands. It opened in 2003 at a cost of over a half a billion dollars. It was built over the crossing of two lines, and allows people to transfer from one to another, and a direct connection to Penn Station in NYC, one stop away.

In 2005, Exit 15X of the of the New Jersey Turnpike opened in front of the station, connecting it to the Interstate road network. The exit ramp passes by the station building then heads out over the interstitial zones by the Croxton railyards on a 2-mile long loop, rising over the swamps in order to site the toll booth, then heads back to the station. Despite this asset, it's the least used exit on the turnpike.

Part of this new hub notion for Secaucus Junction was the construction of a large residential community across from the station and Exit 15X, called Xchange at Secaucus Junction. Construction of the project began in 2006 with the grading and filling of land next to the Hackensack River. After a number of delays the project's first and second phases were complete in 2010. Infrastructure has been laid for a possible expansion of the project.

The Xchange apartments are next to Laurel Hill Park, a county park established at the base of the largest natural hill in the Meadowlands. It's not quite natural anymore, though, as most of the hill was removed over decades of use as a quarry. Laurel Hill Park has one of the few boat ramps on the Hackensack River, and is thus a portal for aquatic forays. It's across from Saw Mill Marsh, and canoes are available to rent here in the summer. Other amenities in the park include sporting grounds for sanctioned activities. The area around the hill has a complicated past. The site has been a church, a poor farm, an insane asylum, a prison, and in 2012, a mechanical dinosaur park. On the other side of the hill is the River Bend Marsh, and the old, overgrown Malanka Landfill, named after its owner, Tony Malanka. The mounds have sunk to less than 70 feet in height.

Continuing northward into Secaucus on Seaview Drive, you enter a large warehouse and office park zone, developed by Hartz Mountain. The privately held Hartz Mountain Company is the largest developer of commercial real estate in Secaucus, and was the first to develop here in a major way. The company expanded from its roots in the pet food industry to real estate by purchasing 1,250 acres of landfilled swamp here in 1969, and turning them into Harmon Cove and Harmon Meadows. The company now has real estate and financial assets all over the NYC region.

The success of Hartz Mountain's developments is based on the once inexpensive real estate and the proximity to the densest and largest markets in the country. Many retailers, especially in the clothing industry, have warehouses here, including Macy's. Data centers are also increasingly being built in a ring around New York City for reasons of economy and security. Equinix's NY4, one of the largest



The Harmon Cove Towers, landmarks of the Meadowlands.

CLUI photo

and newest data centers in the region, is on Secaucus Road, near a Burlington Coat factory warehouse and a Gucci outlet.

Seaview Drive turns north after the Macy's logistics center, and travels along the river as the Meadowlands Parkway. The looming Harmon Cove Towers, a landmark visible all over the Meadowlands, was part of the first major shoreline development negotiated by the Hackensack Meadowlands Commission, in the 1970s. Next to the towers, the rest of the rambling condo development on the river is hard to see from the road, but occupies a considerable amount of frontage on the river.

The HX drawbridge spans the river at the Harmon Cove condominiums, providing an industrial pastoral vista. It is a drawbridge of the bascule type, lifting a counterbalanced span on a hinge. The bridge was built in 1911, designed by Joseph Strauss, the chief engineer of San Francisco's Golden Gate Bridge. Strauss was also a poet who wrote lovingly about redwood and sequoia trees.

Across Meadowlands Parkway from the condos is the North American headquarters for the Panasonic company, a major early anchor tenant in the office park, building the largest warehouse building in the area in 1973. In 2010, the company announced that it was moving to Newark. So much for that. North of the condos is the Crowne Plaza hotel, offering the best views of the Meadowlands available on a daily basis.

Nearby, the Red Roof Inn offers views from a lower elevation, but at half the cost. The Red Roof also offers parking for boats at its docks, including those of the Hackensack Riverkeeper. It is a central Meadowlands location, between the eastbound and westbound bridges of Route 3, across the river from the Meadowlands Sports Complex, and Exit 16 W of the turnpike.

Further up the Hackensack in Secaucus is a small park called Trolley Park. This is where the Patterson Plank Road crossed the river on a now-gone bridge. On the other side is Barge Park, the abandoned driving range, and Xanadu.

At the north end of Secaucus' frontage on the Hackensack is Mill Creek Point Park. Owned by the town, but developed by the Commission, the park provides access to the river and the Mill



## MEADOWLANDS

Creek Marsh, the Commission's first wetlands enhancement project. Mill Creek Marsh extends south of the river to the shopping center at Harmon Meadow, and is bounded on the east by the New Jersey Turnpike's eastern spur.

The marsh is here in part due to mitigation regulations that required the destruction of the marsh for the Harmon Meadows commercial park to be offset by the preservation of marsh here. Recreational crabbers tie traps to the sheet piling at the point, though downstream, in Newark Bay, the crabs are considered so toxic that it would be dangerous to eat more than one every 20 years. Commercial fishing has been banned since the 1980s.

Harmon Meadow is the other big Hartz Mountain development in Secaucus, surrounded by landlocked swampland, and bisected by the Turnpike at its intersection with Route 3. Businesses in the area are mostly big box retail and large chain business hotels. Along West Side Road, which runs along the east edge of the Meadowlands, are the North Bergen Railyards, and the trash sorting and loading facilities of Westside Trans Load, which ships New York regional trash to faraway states by rail.

Up the tracks is Frutarom, the point of origin for some of the mysterious smells that waft over Manhattan, causing alarm and concern. Also along West Side Road are more clothing warehouses, and another major co-location data center, owned by Equinix. Behind it is a Liz Clairborne distribution center, and the Cromakill Creek portion of the swamplands, which flows under the Turnpike and into the Hackensack.

Heading south along the base of Bergen Ridge, the hills that form the eastern boundary of the Meadowlands, the landscape of logistics intensifies. Eastbound, Route 3 goes into a deep roadcut then plunges into the Lincoln Tunnel at Weehawken. The New Jersey Transit rail line goes underground here too, stopping next at Penn Station in NYC. The portal site for the recently abandoned ARC tunnel project, proposed to relieve congestion and provide more public transportation to and from NYC, lies vacant next to the NJ Transit portal.

In the search for remains of the original Penn Station (the ornamental railroad terminal that was torn down in Manhattan in the 1960s, and whose debris was dumped in the Meadowlands) attention has focused on one truck yard in particular on the edge of Secaucus. Remains have been recovered here and in the swamps around the yard. Though in general its hard to say for sure what came from that building in particular, since the Meadowlands are filled in with material from everywhere.

Dumped material dissolves, and is pulled down into the groundwater, the boggy soup that underlies and defines the Meadowlands. The saturated ground leaks and moves, flowing around and through the landfills, and finds its way inevitably to the creeks, like Penhorn Creek, that flows through the truckyards in Secaucus, behind the office parks, past the old pig farms, under County Road and the Croxton railyards, past Secaucus Junction and the Exit 15X toll both, past the Malaka Landfill, and into the Hackensack River, Newark Bay, and out to sea.

### Departure: Leaving the Meadowlands



Flying into the sun over the Meadowlands on the Pulaski Skyway. CLUI photo

Head back into the great bottleneck at the confluence/effluence of Secaucus, Jersey City, Kearny, and the Hackensack, a scene dominated by the smokestacks and the big piles of coal of the Hudson Generating Station, where Penhorn Creek enters the river. The best choice for a way out of here is the Pulaski Skyway.

Leaving Jersey City the Skyway lifts off the ground and flies over the Hackensack and South Kearny. Though it is only a few miles long, the Skyway is in a world of its own, connecting Jersey City with Newark, without hardly a stop in-between. Composed of more steel than the George Washington Bridge, and held together with 2 million rivets, the rusty hulk opened in 1932, as America's first superhighway. What used to take over two hours, zig zagging through the Meadowlands, now took 15 minutes. Some kind of landscape bypassing steampunk time travel machine.

Before you know it you are over the Passaic, past Point No Point and the New Jersey Turnpike, and are whizzing by the Northern State Prison in Newark, headed for the Newark Airport. Before departure, you can take one more stop on the ground, in these former swamplands of the airport, at an overgrown memorial to a Potter's Field. The unvisited memorial is a forgotten place of remembering, it seems, a monument to forgetting to remember. "All around you are the graves of people who, because of life's circumstances, found no other final earthly resting place," say the carved stones at the memorial. "It is appropriate that we remember these lives so long forgotten."

Then back to the AirTrain, and into the world above and beyond the Meadowlands. ♦



Potter's Field, last stop on the tour of the tour of the Meadowlands. CLUI photo



## DESERT RESEARCH STATION REPORT

CLUI OUTPOST IN THE MOJAVE DESERT



*Range Trumpet*, constructed by Deborah Stratman and Steve Badgett, is a set of binaural listening horns modeled after pre-radar acoustic surveillance technologies typically used to monitor the sound of incoming enemy aircraft. They operate like binoculars that provide an amplified stereoscopic image of distant objects. The horn assembly pivots and can be raised and lowered, enabling observers to follow moving objects in the sky or on the ground. *Range Trumpet* is part of the growing collection of sound/space projects on display on the grounds of the DRS. CLUI photo

THE CENTER'S DESERT Research Station (DRS) near Barstow, California has continued to support programming activities for the CLUI in the Mojave region. Several individual researchers have used the site for short stays while working on projects in and about the region, including Moritz Fehr, an environmental sound composer from Germany, and Chris Csikszentmihalyi, a media artist and professor at Art Center College of Design, who worked on aerial photography platforms.

Over the last year, the Center has been meeting with engineers and hobbyists to learn about and test different methods for getting high-resolution photographs from a slightly elevated point of view, in the range between 20 and 400 feet, at elevations generally lower than small aircraft can fly.

Some of these demonstrations and tests have been conducted at and around the DRS, and involved people who shared their technology and experience with inexpensive solutions to aerial photography. Participants included Matthew Lippincott, who has worked on balloon and kite mapping projects with the Public Laboratory, and Cris Benton, a master kite photographer from Berkeley.

Technologies tested include tiny micro-cams, GoPros, and higher-resolution still cameras, mounted on a variety of platforms, such as rockets, small remote controlled helicopters, aircraft, and blimps, in addition to larger helium balloons, hot air balloons, and kites. Photographs were taken from different retractable camera poles extending as much as 30 feet. Research was even performed on different types of throwable cameras, such as cameras embedded inside foam balls.

Several tests were conducted at outdoor photo calibration targets, left from an earlier era of aerial photography research, now unused on public land around Cuddeback Lake, northwest of the DRS.

After a year of research, a number of conclusions were reached, some obvious, others not. For images up to 25 feet above the surface, nothing beats a decent camera mounted on a pole, such as

the fiberglass telescoping Wonderpole from the American Flag and Banner Company, which extends to 22 feet reasonably safely with a full-size four-pound digital SLR on it.

To get higher, kites work well when it's windy, and with practice you can get them up pretty quickly, and then connect a camera platform to the kite string, and let it up some more. The critical piece of hardware is the picavet cross that attaches at two points on the kite string, and which is strung in a certain way so that the camera platform stays level, regardless of the angle of the kite string. When it's not windy, then a helium balloon works well. Small weather balloons, with a four-foot diameter, have enough lift for a small digital camera, and can be purchased easily. You can simply dangle a camera from one if you are shooting straight down, using rubber bands to hold it in place, and an intervalometer to trigger the shutter. For angled shots, lightweight adjustable camera rigs can be obtained from sources such as [www.brooxes.com](http://www.brooxes.com) for use on balloons or kites.

The problem with balloons is the helium, and lack thereof. A large helium tank weighs around 80 pounds, and can fill a balloon only six or so times. And there is currently a helium shortage, so prices are going up, and some helium suppliers are refusing to sell it to anybody but medical and industrial customers. For these reasons and more, balloons are less than ideal for regular use in the non-windy situation when a kite is not possible. The ideal replacement could come from the booming world of remote-controlled aircraft, especially multi-blade helicopters, which are more stable, such as six-bladed hexacopters.

Meetings and demonstrations were held with owners and operators of remote control hexacopter camera platforms, used in commercial photography and film productions, as well as serious RC aircraft developers, like the members of the DIY Drone online community, led by *Wired* magazine's Chris Anderson. Though innovative, these devices are usually complex to maintain and fly. The most compelling mechanical solution, as suggested by DIY Drone member David Long, is a simplified hexacopter, that flies only up and down, staying fixed automatically above the launch point by GPS, serving as an elevator to get a camera straight up, with minimal skill and fuss. This contraption is in development, and will be field-tested at the DRS. ♦



Los Angeles-based artist and CLUI Wendover Residence Program participant LeRoy Stevens installed a large subsurface metal sculpture at the DRS. "Viewers" of the work use a variable-pitch metal detector to "see" the piece. CLUI photo



## WENDOVER REPORT

CLUI COMPLEX IN THE GREAT SALT LAKE DESERT



Film crew shooting zombie movie in Wendover.

CLUI photo

THE CENTER'S COMPLEX in Wendover, Utah had another busy season in 2012, with several class visits in addition to a full house of official residents, and other visitors. The work of several past residents was put on display, including separate exhibits by Dan Torop, Jen Hofer, and Brian Rosa and Adam Ryder. David Jones, Patrick Kikut, and Shelby Shadwell, three artists who were in residence in 2011, who make work together and teach at the University of Wyoming in Laramie, installed their exhibit *GOLDMINES!* in Exhibit Hall 2.

New participants in the residence program in 2012 included LeRoy Stevens, Tom Jennings, Anna Neander, Max Stocklosa, Lucy Livingstone, and Kathleen Shafer.

Visitors included several past residents, working on new projects, and numerous passers-by coming to see the exhibits, most of which are open year-round (unlike the residence program, which operates seasonally from April 1 to November 20). Filmmaker Tacita Dean came through town with her film crew, working on a film about J.G. Ballard, *Spiral Jetty*, and the nearby Salt Works. And a film crew used some of the barracks buildings for a cable TV zombie project.

Robert Golka, the high-energy experimental physicist who set up a lab inside the Enola Gay hangar around 1980, spent some time in town this year, and visited with CLUI residents. Golka and his project at Wendover were the subject of Robert Frank's 1981 film *Energy and How to Get It*, which features William Burroughs, Robert Downey Sr., Rudy Wurlitzer, and Dr. John, and is a cinematic landmark of Wendover's history of experimental research.

The two *Land Arts of the American West* programs, from UNM and Texas Tech, stopped by separately for a week each in September, and did work on and about the region. The annual Wendover Work Party projects included preparing a new exhibit hall next to the orientation building. Participants in the 2012 Wendover Work Party were Matthew Coolidge, John Fitchen, Helki Franzen, Oliver Hess, John Hogan, Cooper Jacoby, William Keddell, Jed Lackritz, Hikmet Loe, Ben Loescher, John Mack, Sohrab Mohebbi, Kate Moxham, Norah Plum, Eric Potter, Paul Stout, Aurora Tang, and Wendy Wischer. Thanks to the crew for their great work! ♦

## IMAGES OF INTERSTATE CULVERTS

FEATURED IN *DOUBLE CROSSINGS* EXHIBIT



Interstate 80 spans the salt flats in northwestern Utah, and for a distance of 38 miles has neither a curve nor an exit. This linear element of conveyance cuts through the salt flats from east to west, dividing it in two. Drainage between the north and the south exists only at a few points where culverts have been provided perpendicularly through the raised gravel roadbed. CLUI photo

ALL THE CULVERTS and drainage pipes along the salt flat stretch of Interstate 80 were photographed by the CLUI and shown in an exhibit at the MAK Center in Los Angeles. The exhibit, *Double Crossings*, showed these images alongside the work of Austrian artist Hans Schabus, who made a map and photographs of every bridge and pipeline crossing of the Los Angeles River.

Together, these two crossings suggested a whole made from complementary opposites: one urban, one rural; one wet, one dry. The highway in the salt flats is a linear form made by the human need for conveyance, crossed occasionally by structures beneath it that allow for drainage to flow through small tunnels, pipes, and culverts. The Los Angeles River, conversely, is a flowing linear drainage channel, spanned by human needs of conveyance, traveling over it, on bridges.

These two sets of crossings, though separated geographically, converged at the MAK Center, in parallel exhibits of the maps and photographs by Schabus and the CLUI, with images projected on opposite sides of a dividing wall. Together these works comment on different qualities of conveyance, different extremes of environments, different modes of perception, and our relationship to what was once known as the "natural world," but is now something else entirely. ♦

*Double Crossings continues through March 2, 2013, at the MAK Center Mackey Garage Top, 1137 S. Cochran Ave, Los Angeles.*



## NEW MEXICO EXHIBIT UNIT REPORT SANDIA NATIONAL LAB EXPLORED



View of the exhibit *Testing, Testing, Testing: Experiments in a Post-Nuclear Age at Sandia National Laboratories*.  
Louis Schalk photo

SANDIA LABORATORY WAS the subject of an exhibit in the Center's New Mexico Exhibit Unit, produced by students at Albuquerque Academy and their teacher Louis Schalk. The exhibit was open to the public over several weeks last spring and summer. It was also open during the ISEA Machine Wilderness conference held in Albuquerque in September, which brought a wide variety of creative researchers and artists from all over the world to the city.

Titled *Testing, Testing, Testing: Experiments in a Post-Nuclear Age at Sandia National Laboratories*, the exhibit focused on the activities at the lab's Albuquerque location, located immediately behind the CLUI New Mexico Exhibit Unit. Sandia's field test area there contains some of the most dramatic outdoor impact and effects test facilities in the world. Tech Area III, for example, includes dynamic shock test beds, centrifuges, and drop towers, for studying the effect of accidents, collisions, fires, and explosions on sensitive materials and objects, such as nuclear bombs. The largest of these is a 10,000 foot long sled track, capable of reaching speeds up to Mach 3 before slamming test objects into a concrete wall. Tech Areas IV and V are used for radiation effects research.

The Albuquerque Academy students put together the Sandia Lab show after visiting the lab's back-spaces and tech areas with Sandia representatives. This was the third exhibit produced by Schalk's Albuquerque Academy class in conjunction with the CLUI over the past three years. ♦



Albuquerque Academy students inside the CLUI New Mexico Exhibit Unit.  
Louis Schalk photo

## OBSERVING THE OBSERVATORY RISING ABOVE A MOUNTAINTOP DOME



Looking down on the 100-inch telescope.

CLUI photo

LAST SUMMER THE CLUI took its aerial photography platform to new heights at the Mount Wilson Observatory, the historic astronomical center atop the San Gabriel Mountains, more than a mile above Los Angeles. CLUI members deployed a helium balloon-mounted camera to take aerial photos of the domed enclosure of the 100-inch telescope, once the largest telescope in the world.

The project was part of an event called *Knowledges at Mount Wilson Observatory*, a program of creative events and performances that took place on the grounds of the observatory over two days in June, 2012, mostly at night. The remarkable event transformed the hallowed grounds of the observatory into a technologically enchanted forest of colors, lights, sounds, and other surprises.

The image taken by the CLUI was intended to offer a new perspective of the observatory's telescope—seen from above—as it is usually depicted as seen from below, and is, of course, used for looking up. The image was framed and presented to the observatory director, and was hung in the visitor observation room that overlooks the 100-inch telescope. ♦

## HUELL HOWSER 1945-2013

HUELL HOWSER WAS the host (as well as the creator, writer, producer, director) of the popular California public TV show *California's Gold*, and other similar programs. Each episode was an emphatically enthusiastic celebration of curiosity and interest in some place that he had heard about or happened upon, somewhere in California. Over 25 years, his shows featured hundreds of places, from obscure local businesses to well-known historic attractions. He was the modern-day California booster, who generally rooted for the local and small-scale. He once called to tell us our newsletter was "Amazing! How do you find out about all this stuff?" which was nice to hear. Once we visited him in the desert, a trip that turned into a crazy Huell-fueled tour of points of interest (and real estate) around Twentynine Palms, and Wonder Valley. Everywhere we went, it was like the TV show, full of unflappable and contagious positive energy. California is less golden without him. ♦



## THE NATION'S MEDIA ARCHIVE

*continued from page one*

The Culpeper facility started out as a three-level underground building built by the Federal Reserve and the Treasury Department in 1969 to house the hub of their nationwide communications network, and to store a staggering \$241 billion in cash (including rows of palletized \$2 bills), which would be used to jump start the economy after a nuclear attack. The site also served as a continuity of government facility, with a regular staff of 100 on hand to care for selected government officials who would flee to it in the event of nuclear war. With changes in technology, the development of new facilities, and a decrease in the perceived need for nuclear-attack proof bunkers, the Fed, which by then had a number of bunkers around the country, declared this site surplus in 1993. It was listed on the open market for a time, before being purchased and repurposed for the Library of Congress.

Knowledge, as they say, is power, and the Library of Congress is generally considered to be the largest library in the world, with over 150 million items, on hundreds of miles of shelving, in several buildings and storage areas in and around Washington DC, including this one at Culpeper, Virginia, 60 miles away.

The Library of Congress, started in 1800 as a reference library for policymakers, was initially housed in the U.S. Capitol building. After the British burned the Capitol in 1814, the library was started again with the purchase of Thomas Jefferson's personal library of 6,847 books. As it grew, new buildings were added, starting in 1897 with the Jefferson Building, then the Adams Building (1938), and the Madison Building (1981), massive edifices next to one another, located prominently behind the U.S. Capitol Building.

The library has already outgrown these structures, and it is doubtful that another library building will be made around the Capitol. The future is in storage, and digitization. Its main off-site storage facilities are the Book Storage Module buildings at Fort Meade, Maryland (also home of the nation's largest data processor, the NSA), where in coming years, as many as 50 million items will be stored in more than a dozen structures.

While the bulk of the library is books, audio-visual material has been collected all along as well. Since inclusion in the Library of Congress is one of the methods for establishing copyright for any kind of published material, it has been routine to send copies of new books, movies, TV shows, and audio recordings to the library on their release. The library has more than five million audio-visual recordings, and most of them are being consolidated at the converted Federal Reserve site in Culpeper, Virginia, officially known as the National Audio-Visual Conservation Center, also known as the Packard Campus.

The Packard Campus is the product of the vision of David W. Packard, whose wealth comes from his father's Hewlett Packard computer company, and whose interest in old Hollywood movies has been evident since at least 1987, when he restored and re-opened a movie theater dedicated to screening classic films, in Palo Alto. Packard bought the former Federal property at Culpeper which was being offered on the open market, in 1997, with an

initial \$5.5 million from the family foundation, in order to give it to the Library of Congress. After ten years, and an additional \$250 million or so, most of it coming from Packard's Humanities Institute, the National Audio Visual Conservation Center opened in 2007.

## A TOUR THROUGH THE PACKARD CAMPUS

## The Conservation Building

Three connected buildings make up the campus: two underground storage buildings connected to the above-ground conservation building in the middle. The conservation building is the largest structure, 175,000 square feet on three floors, and houses administration, preservation, and conservation functions of the campus. Inside are the offices, labs, processing facilities, and other work spaces where the staff of around 110 people work.

Just off the lobby is a theater, with near-perfect projection and audio equipment, where films are screened for the public, twice a week. Though it seats only a couple hundred, the theater is equipped to show 16, 35, and 70mm films, and is one of only five theaters in the country permitted to screen nitrate films, the flammable film medium used for most early films, which caused many movie-house fires before it was replaced in the late 1940s. The theater was designed by Mr. Packard to resemble the theater of his youth in the Silicon Valley.



Culpeper has a number of collections from corporations, organizations, and individual archivists. The Library of Congress acquired the Prelinger Archive in 2002, consisting of 48,000 pieces of "ephemeral" films, and it is taking a while to ingest it. Some of the 500 shrink-wrapped skids line the halls of the first floor of the collections building. CLUI photo

The bulk of the audio-visual material archived here was shipped to Culpeper from storage sites all over the country before it opened in 2007. Now around 150,000 new items arrive every year. The majority of its holdings are audio recordings—on tape, wax discs, vinyl LPs, and every other conceivable format. The rest is motion pictures, television, and other types of video, on tapes, film, and digital hard drives. The library even collects video games in every conceivable format as well.

While the Library of Congress is interested in having a copy of any published audio-visual material shown or produced in the United States, not every audio-visual item sent to the Library of Congress finds its way to Culpeper. Unsolicited material is screened at processing sites elsewhere, and is forwarded on to Culpeper only if it is desired, and non-redundant.



The second floor of the main building is focused on the conservation of recorded sound materials, with vinyl and acetate disc cleaning rooms. Also on this floor is the data center and tape archive. The digital storage area for the entirety of the collection is kept here and shipped off-site electronically for back up. CLUI photo



The digital audio archive at Culpeper is a Sun/Storage Tech storage tape cartridge system, with five cabinets containing a total of 37,500 slots for individual memory cartridges. The capacity of each cartridge is currently one terabyte, but is being upgraded to five terabytes, and those cartridges can be replaced with higher capacity cartridges as they are developed and needed. With this system, the storage capacity will always be ahead of the demand, and the storage medium is easily refreshed. The current capacity is 10 petabytes, and so far the archive has around two petabytes of stored material on these drives (2,000 terabytes), which doesn't sound like much, now that consumers can buy pocket size terabyte drives for less than \$100, but it already contains around three million individual audio recordings, probably the largest digital sound archive in the world. CLUI photo

The third floor of the main building has the most elaborate equipment, used for both sound and video. This is where analog to digital transfers take place, in finely tuned, sonically isolated rooms, and where racks of specialized digitization equipment crunches away at streams of analog (and digital) input. On the analog side, 35mm motion picture film duplication and processing takes place on this floor, and batteries of the full-spectrum of consumer and commercial audio and videotape players are used to dump their content into digital formats.



There are nine critical listening audio transfer rooms, which are sound-isolated chambers, generally with analog playback devices, digital recorders, and workstations to control them. The rooms are equipped with the best high-fidelity equipment possible: \$20,000 custom-made Simon Yorke Turntables, Studer reel to reels, and \$10,000 ATC speakers. Digital-to-audio converters record at 96K, and make 24-bit digital preservation files. CLUI photo

The third floor's Technical Operations Center is where most of the digital video recording takes place. A system known as the Semi Automatic Migration of Assets employs things like robotic videotape-loading mechanisms that select and load tapes into stacks of rack-mounted players for high-speed through-put dubbing and digitization employing JPEG 2000 compression.

Not everything here is about converting signals from analog to digital. Some material comes in digital form, on DVD, master tapes, and hard drives. Another born digital process for capturing program content is the live capture process, where equipment is being set up to capture 120 streams of broadcast television, mostly satellite television from Direct TV and Dish Network, which will be continuously recorded for permanent digital storage in the deep archive. Radio programs from 42 internet stations, 10 FM stations, and the XM/Sirius satellite radio network will also be captured on a system using 72 Mac-minis.



Since every conceivable format for audio and visual recording from any era is kept at Culpeper, machines to play the media are stored at the facility as well. And since many of these machines are or will be obsolete, several of each need to be kept for parts in order to repair the equipment, potentially perpetually. This includes the lowliest commercial format like 8-track tape cartridge players, to high-end commercial videotape mastering equipment. Several rooms are used to store and service this equipment; one especially large one is referred to as "The Raiders of the Lost Ark" room. CLUI photo



The nitrate archive is divided into two pods separated by a door and accessed along one central hallway, along which on either side are a total of 124 vaults, each with its own door. The entire vault area is maintained at 39 degrees F, and at 30% humidity. Before the entrance to the vault area there is a transition room where material is acclimated before and after it is stored. CLUI photo

## The Underground Vaults

While the conservation building houses the processing functions of the Packard Campus, the two underground storage buildings that flank the main building, one on the east, and one on the west, contain the physical archives of audio and video material. The west side is the main collections, and the east is the nitrate film vault.





Typical vault in nitrate archive. Each of these vaults has shelving space for over 100 cans, giving the facility the official capacity of 145,056 reels of film. To limit potential losses due to combustion of the unstable nitrate films, the shelves are designed to hold only a few items each, with room to set items back from the edges. Dual sprinklers in each vault run down the full extent along the front of each of the shelves, and a blow-out vent at the back of each vault runs for 25 feet to the surface to vent outside in an emergency. CLUI photo

The nitrate film vault is a 55,000 square-foot structure, built new for this purpose, and intentionally isolated from everything else because of the volatility of nitrate film. Nitrate film was the primary flexible film base for motion pictures, used from the late 1800s to 1951, when it was replaced with acetate safety film in the USA. It is composed of nitrocellulose, which is very flammable, and more so as it degenerates. Numerous disastrous fires in movie houses occurred over this period, and a number of film archives have burned and lost some of their contents (including the Eastman House and the National Archives). It is estimated that more than 75% of the early silent films produced in the USA, all of which were printed on nitrate film stock, have been lost.

This is the largest nitrate film vault in the nation, and one of only a few, including the Museum of Modern Art's Film Preservation Center, in Hamlin, Pennsylvania; the George Eastman House's vault at the Louis B. Mayer Conservation Center, in upstate New York; and one at UCLA, being built by Packard. Prior to coming to this location, all of the Library of Congress' nitrate films were kept at Wright Patterson Air Force Base in Ohio.



In the collections building, most of the film is stored on rolling high-density compact shelving, which doubles the storage capacity of the rooms. Film masters are kept in five separate vaults, and chilled to 35 degrees (and as low as 25 degrees) and 30% relative humidity, and less precious access film copies are kept at 45 degrees and 35% humidity. Another group of vaults on the first floor, used for storing videotape, much of it in production quality formats such as 1" reel to reel spools and 3/4 inch cartridges, are kept at 50 degrees. As with the nitrate vaults there is an acclimation chamber on this level, primarily so material can slowly warm up to the outside temperature. CLUI photo

The other vault area, where all of the non-nitrate films, tapes, and other files are kept, is known as the Collections Building, a three-level underground structure on the west side of the main Conservation and Administration building. This structure was the

original Federal Reserve Bank bunker, in use until 1992. When construction for the Packard Campus began, the entire old building was gutted, and even the soil cover above it was removed, exposing the concrete, in order to seal it better from moisture penetration. The machine gun turret at the top was removed, as was the security bunker at the entrance. The concrete slabs and pillars are all that remain from the original building.

The Collections Building uses all the 135,000 square feet of the original building's three levels, plus a bit more for mechanical space at the top. It contains 34 vaults on two floors. The first floor is taken up by room sized vaults for film and video storage. The second floor of the Collections Building is for storing sound recordings, and is kept at 50 degrees and 35% humidity. It has more than a dozen room-sized vaults for every material in every conceivable audio format, including audio-cassettes, wax cylinders, and even 19th century copper discs. One long room of shelving is possibly the largest LP collection on earth.

The top floor of the Collections Building, where the former dormitories for the Continuity of Government and the staff of the Federal Reserve technicians and security teams used to be, is still undeveloped space used for storage. The floor has possible weight capacity problems and may not be able to bear the load once converted to archive space with high-density shelving. This matter is being assessed, and the outcome will affect the ultimate capacity of the archives. Culpeper was expected to reach full capacity over the first 25 years of its existence, and it is now eight years old. Capacity will be reached a few years earlier if the third floor cannot be fully developed.

The original Culpeper bunker was built on the slope on Mount Pony, the highest elevation in the county (a hill that was historically used as a signal station as far back as the Civil War), on the southwest side, facing away from Washington DC, to protect the bunker from the blast effects of a nuclear attack on the Capitol. Though the allure of features like this provided the attraction that got the conservation center going in the mind of its benefactor, David Packard, the real value of having a portion of the Center underground is debatable. It is likely that it would have been cheaper to start from scratch, than to convert the existing facilities.

But the heritage of the place, as an early computer node for a nationwide electronic communication network, is not entirely without practical benefits, as well as symbolic ones. The Federal Reserve communication system was a 40,000 mile network, stringing the reserve banks of the nation together. Every single check cashed in the USA, and every other electronic transfer of funds or securities between banks, was conveyed on this system. These wires were the veins of the nation's economy, and Culpeper was its heart.

These wires became corridors as the communications infrastructure of the nation expanded, and the region around Culpeper is full of other government and civilian communication network sites, from the Cold War and now. The corridors left by Culpeper's former use have been repurposed, and are now used to send streaming audio and video programs, housed on the campus' servers, to the library's listening rooms in Washington DC. Culpeper, built with its back to the nation's Capitol, now faces it head on, taking our collected past into the future. ♦

## BOOK REVIEWS

## BOOKS NEW TO THE SHELVES OF THE CLUI LIBRARY

**Tubes: A Journey to the Center of the Internet**, by Andrew Blum, Houghton Mifflin, 2012

In 1996, science fiction author Neal Stephenson published *Mother Earth Mother Board*, a revolutionary nonfiction piece in *Wired* magazine, where he followed the installation of a new fiber optic cable across the globe. Finally, we thought, *Wired* magazine becomes true to its name, and talks about wires, and maybe now there would be an open dialog about the global geography of communications infrastructure and connectivity. For the most part, though, this was not to be. Only in the past couple of years has the physical form of the internet begun to be discussed again in popular media, such as the recent coverage of Google's "outing" of its datacenters. Andrew Blum's new book is an excellent and encouraging foray into the subject, and we hope there is more to follow.

**Petrochemical America**, by Richard Misrach and Kate Orff, Aperture, 2012

Photographer Richard Misrach's Cancer Alley photo works from 1998, depicting the communities, industries, and landscape of the Mississippi River between New Orleans and Baton Rouge, join a new set of his photos from trips in 2010, creating an epic of foggy and crisp images of things like fences with danger signs running through swamps, and trailer homes and graveyards with refineries behind them. The second part of the book, which takes up exactly half, is titled *An Ecological Atlas*, and is by Columbia University professor Kate Orff and her team. It is an architectural studio project that focused on the region, generating graphics and maps that depict the relationship between petrochemical products, humans, contaminants, and landscape, locally, and in general. The two-part book is reminiscent of Misrach's *Bravo 20*, about a bombing range in Nevada that he wanted to convert into a park.

**How We Forgot the Cold War: A Historical Journey Across America**, by Jon Wiener, University of California Press, 2012

A book (which includes some images from the CLUI archive) of entertaining musings and accounts of visits to Cold War museums and memorials, such as the NSA Museum, Greenbrier Bunker, bus tours of the Hanford Reservation and the Nevada Test Site, as well as relevant presidential libraries, and media exhibits, like the Newseum. Wiener argues that there is a dearth of Cold War memorialization in the country. That may be, though in a way the entirety of the contemporary landscape of the USA is a memorial to the Cold War.

**Fordlandia: The Rise and Fall of Henry Ford's Forgotten Jungle City**, by Greg Grandin, Metropolitan Books, 2010

Henry Ford's concept of vertical integration sometimes went all the way to the source of the raw materials needed to produce the parts for his cars, as well as into the lives and communities of the people who worked for him. This is the story about his attempt to control the production of rubber, and inflict his ideas about how people should, or could, live in an industrial/agrarian rubber plantation outpost in the Amazon jungle. The small, remote city he built there, which he never even visited, failed in both regards, and is now mostly an overgrown ruin.

**Sealab: America's Forgotten Quest to Live and Work on the Ocean Floor**, by Ben Hellwarth, Simon & Schuster, 2012

To say this book is the missing link would be both true, and a bad pun, since its largely the story about Edwin Link's remarkable and independent pioneering into the world of the deep. Link (famous for the Link Trainers that were used to train pilots in WWII) spent most of his post-war energy and resources in developing ways for people to live and work at tremendous depths, and on the ocean floor.

It's also the story of another adventurous innovator, Commander George Bond, of the U.S. Navy, who spearheaded the government's various Sealab experiments, and who was not afraid to leap out of submarines at depths of 300 feet, wearing just shorts, a mask, and a lifejacket. It really is like a "Right Stuff" story, but in reverse: where the astronauts are aquanauts, where up is down, and pressures quickly increase, instead of decrease, and dramatically so.

**The Half-Life of History**, by Mark Klett and William L. Fox, Radius Books, 2011

A large-format photo book mostly about Wendover (where the CLUI operates a residence program) and the town's Enola Gay Hangar, where that famous plane was before it went to Tinian, then to Hiroshima to drop the Bomb. Fox (the writer) and Klett (the photographer) have worked together before, on Klett's Third View rephotography projects, for example. They were in residence at CLUI in 2001 and 2006 to work on this book. They have produced a vivid portrait of the structures, surfaces and debris associated with this period, and the evocative corruptions that time and the elements have applied.

**Ends of the Earth: Land Art to 1974**, by Philipp Kaiser and Miwon Kwon, Prestel, 2012

The big book of the big show at the Museum of Contemporary Art, in Los Angeles, curated by Philipp Kaiser and Miwon Kwon. Adds many new works and texts to the legacy of land art. And makes it official, that whatever it was, it is no more. Land art was a historic moment of emergence. Early land artists discovering the world beyond the gallery were like astronauts going to the moon. Land was encountered formally, as a new substance. It was poked, prodded, dug, displaced, replaced, and specimens were taken back to the lab/studio/gallery/New York. It's hard to imagine a day when just thinking about art existing in places beyond a gallery was novel. But it had to start sometime. Once this realization was made, the world opened up, and art was free to roam anywhere.

**Making the Geologic Now: Responses to Material Conditions of Contemporary Life**, edited by Elizabeth Ellsworth and Jamie Kruse, Punctum Books, 2012

A book edited by the team known as Smudge, who collected and solicited work from dozens of interesting people who most likely at least share the thought that the use of the new "geologic" term *anthropocene* makes sense. Hard copies are available from the publisher, and the book can be viewed at [www.geologicnow.com](http://www.geologicnow.com).

## THANKS TO OUR FRIENDS AND SUPPORTERS

The CLUI would like to thank the following for their substantial assistance and support of things covered in this newsletter: Metabolic Studio, a direct charitable activity of the Annenberg Foundation, The Andy Warhol Foundation for the Visual Arts, Graham Foundation, The National Endowment for the Arts, Lannan Foundation, Kindle Project Fund of the Common Counsel Foundation, Orphiflamme Foundation, and Creative Capital.

The Winter 2013 issue of *The Lay of the Land* is dedicated to the memory of Laura Tatum.

## CLUI CORPS

CLUI Corps, A-Z: Steve Badgett, George Budd, Matthew Coolidge, Tristan Duke, Helki Frantzen, Jen Hofer, John Hogan, Cooper Jacoby, Erik Knutzen, Ben Loescher, Meredith McDaniel, Ryan McKinley, Rachel Portenstein, Rob Ray, John Reed, Steve Rowell, Sarah Simons, Deborah Stratman, Aurora Tang, Tellef Tellefson, Dan Torop, Igor Vamos.

Newsletter Editors: Matthew Coolidge, Sarah Simons, Aurora Tang.





Tri-bar photo resolution target near Cuddeback Lake, California.

CLUI kite photo by Cris Benton



THE CENTER FOR LAND USE INTERPRETATION  
9331 Venice Blvd.  
Culver City, CA 90232  
[www.clui.org](http://www.clui.org) [clui@clui.org](mailto:clui@clui.org)