The Astrodome: Building an American Spectacle

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SPEAKERS

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Thank you all for inviting me today.

I've done this talk quite a lot and whenever I do this talk, I find people want to come up and talk to me, tell me their Astrodome stories and there's lots of interesting stories that happened in this building in nearly 40 years in the city of Houston.

But for me, the reason for the book, in my interest, is the story of the creation of the building itself. It's a really interesting story.

It's a story of people and technology. People, Judge Hofheinz, hard to think of a more interesting character for any book than Judge Hofheinz. And also the technology, the new technology involved in making what was, at the time, the biggest room in the world. And the fact that that new technology didn't always work quite right and that's an interesting part of the story also.

But as I got more and more into the research, I found that there were other stories happening in the background in the early 1960s. The book focuses on the period between 1960 and 1965. That's when design of the Astrodome began in 1960.

We had, of course, the space program, which was influencing history, not just in Houston, but throughout the country. And the Astrodome, its creation is not unlike the space program. A very ambitious goal, a very aggressive schedule, and a real can-do attitude.

We also had, during that period, the Cold War very much a factor in American life. And Cold War planning affected the design of the Astrodome.

And then finally, we had the story of desegregation, the end of the Jim Crow era. When the design of the Astrodome began in 1960, Houston and most other cities in the south were segregated cities. And by the time the Astrodome opened, in 1965, those Jim Crow laws had been done away with. And Houston was an integrated city.

Now, that didn't happen because of the Astrodome. But the Astrodome played a small role in that change of history. And I got very caught up in Houston's history of building big buildings in a hurry. And I talk about this a lot in the book.

I talk about this structure. That's the convention hall built for the 1928 Democratic Convention, which was held in Houston. This building occupied a full city block. The Hobby Center sits on the site today. Built entirely out of pine from East Texas. Built in 60 working days. Up it went.

And, of course, Colt Stadium, the temporary home of the Colt 45s while the Astrodome under construction. Built in four months.

And that, of course, is Rice Stadium. We'll talk about that a little bit later in this presentation.

So, we start with a little bit of an architectural history lesson. And a look at what were the biggest rooms in the world just after the birth of Christ.

Here we have the Pantheon in Rome. And here we have the Florence Cathedral. The Pantheon built about 100 years after the birth of Christ. The Florence Cathedral built in the 1400s. These two buildings were the biggest rooms in the world for nearly 2,000 years. And they had an interior clear span, meaning the distance from there to there. About 140 feet to these two. So, these two buildings actually held the record up until the middle of the 19th century.

Now with the 19th century, we started to get bigger buildings. We had the advent of steel and iron construction. We had the advent of prefabrication. And we had the advent of the railroads. So we started seeing much, much bigger rooms.

St. Pancras Station in London on the left, that's a 243 foot span. And one of the biggest train sheds ever built in the world was built in Philadelphia, 300 foot span.

We also had, in the 19th century, the rise of international exhibitions. And this was a very big deal. Cities would have an international World's Fair periodically, and a different city would have it every few years.

And the cities all got very competitive, trying to outdo each other with how grand their buildings would be and how big they would be. So typically, you'd have a giant building full of products and wares and the products of different countries.

Look at this. 364 foot span. This was Paris in 1889. Look at the human figures. Look how big that building is. 364 foot span.

And then, of course, in the 20th century, we had the advent of aviation and blimp hangars, dirigible hangars, in this case, on the west coast for Navy dirigibles. Again, about a 300 foot span.

So, we've taken a few minutes. We've had a very interesting look at about 2,000 years worth of design and architecture and engineering. And these are really some remarkable engineering feats. But each of these buildings had a significant drawback.

None of these buildings was big enough to hold a baseball game. Baseball takes a lot of space. Football, not so much.

Football actually had been played indoors starting in the 1890s. And in this picture here from the Atlantic City Convention Center in New Jersey, there's a football game being played inside in 1929. No problem. The field fits. A few spectators fit.

And actually, the first enclosed stadium proposed in Houston was not the Astrodome. It was proposed for the National Football League by Mr. Glenn McCarthy, who was trying to attract a team in 1950 and could not get the football league interested in bringing a team to Houston at that time. But that was the first talk of a domed stadium in Houston.

But look at the difference between a football field and a baseball field. Baseball takes a lot more space.

So, let's take a look at what was going on in baseball fields in the 1950s. Anyone who knows a little bit about the history of baseball has heard of Ebbets Field in Brooklyn. This is where the Brooklyn Dodgers played starting in 1913 up until the late 1950s. And nowadays, everyone's very nostalgic about Ebbets Field and fields of that era. However, as we came out of World War II and into the 1950s, these facilities were getting kind of long in the tooth. They were mostly built in the 19-teens. Ebbets built in 1913. And they were pushing 40 years old and kind of worn out.

This is the owner of the Brooklyn Dodgers, Walter O'Malley. Take a look at the plan of Ebbets Field, how hemmed in it is by this urban street grid. And therefore, you ended up with a very irregular baseball field. And in the 50s, people were kind of tired of that. They thought that baseball fields should be perfectly symmetrical and more spacious. O'Malley was very unhappy, lots of seats blocked by columns, old building, old infrastructure.

And the biggest problem of all, parking. This building was built when car ownership was not very common and only had 700 parking spaces. And it wasn't flying because baseball stadiums in the 1950s were encountering some significant competition. And that was from television. Much easier to stay home and watch the game on television than to get in the car and drive down to Brooklyn and try to find a place to park, unable to get one of those 700 spaces.

So by the 1950s, baseball owners had kind of had enough and were looking for a new generation of baseball stadiums.

So it was O'Malley who was the first person to actually try to build an indoor baseball stadium. And he hired a couple of pretty prominent designers.

This is Norman Bel Geddes, a very famous industrial designer. And Bel Geddes designed a retractable roof baseball stadium.

This drawing made in about 1952 for Brooklyn. Take a look at the amenities that they were proposing at the time. Now remember what I told you about television, baseball trying to compete with television. So this is from Collier's Magazine in 1952. Look at the amenities. Yes, you could go to the game, but you could also go to the supermarket. You could go to a movie, go to daycare, get your car worked on downstairs. It was really trying to make the ballpark attractive to families.

Look also at the stadium, at the dimensions of the field. Perfectly symmetrical. No nooks and crannies, no little irregularities. So that was the goal.

So O'Malley also collaborated with a very famous engineer and architect, Buckminster Fuller. Fuller invented the geodesic dome, which was a revolutionary, highly efficient structure for enclosing a dome space. So these two guys collaborated for a while.

But as we all know, the Dodgers did not stay and make that stadium in Brooklyn. They moved to Los Angeles in the late 1950s to a conventional open-air stadium. So there was still no room big enough for a baseball game.

So let's take a look at the state of baseball in the year 1957. And that's when serious discussion started in the city of Houston about bringing a baseball team to the city.

Note that there's no team south or west of Kansas City. All the teams concentrated in the industrial northeast. No Seattle Mariners, no Minnesota Twins, all in the industrial northeast. And that was starting to do trouble certain citizens of Houston.

The gentleman on the left is George Kirksey. The gentleman on the right is Craig Cullinan. Kirksey, a sports writer and a public affairs consultant, a baseball fanatic. He was the kind of guy, if you saw him at the baseball game, hey, George, how you doing? He's going, shh, shh, shh, shh. Don't interrupt the game. Craig Cullinan, a little smoother, heir to the Texaco fortune. Yale man sent up north to be educated and then came back down. These two collaborated trying to attract major league teams to Houston. And they did so for several years without success. Why? No stadium.

So in 1958, they encouraged what was then the Park Board of Houston to hire architects to design the stadium. They hired two firms.

The first firm was Wilson, Morris, Crain & Anderson. These gentlemen were largely doing residential work, a lot of club work, smaller apartment buildings, things like that. No sports stadium experience.

The other firm was Lloyd & Morgan, later Lloyd, Morgan & Jones. This firm had a little more experience with big buildings. And actually, it was they who designed Rice Stadium. And

this is another Houston, an amazing Houston story of construction. This building was designed and constructed in 11 months. Working triple shifts all through the winter to build this stadium in time for opening day in September of 1950.

So, these four architects got to work on designing what would have been a conventional stadium. And they started by doing a siting study. This is the siting study they did. So there's downtown. A downtown site never really considered.

All the sites they considered were in the suburbs. And what would become the Loop. You can see the dotted line there representing the Loop to be built in the future. One of the most attractive sites at the beginning was what is now Memorial Park. It was then Memorial Park, I should say. And they were chased off of that land pretty quickly by the Hogg family. And wound up down in the site that you know of today. But these are the sites that were considered for the ballpark.

Now, conventional stadium, but they knew they wanted both football and baseball. So, at the time, football was not really very popular. Pro football was not really very popular in the United States. Baseball was the game. So, football teams were always tenants in baseball stadiums.

This was one of the earliest attempts to design a truly convertible stadium. So, you can see it here in its baseball configuration. Then these stands would move into position. And they'd play football there. But no roof on the stadium. That's yet to come.

So, entering the picture along with Kirksey and Cullinan were Bob Smith, a self-made oil man. The wealthiest individual in Harris County in the 1950s. And the largest landowner in Harris County. And he was a close collaborator with Judge Roy Hofheinz. And Hofheinz, of course, is the star of our story. A remarkable individual. He passed the bar exam at age 19. He then became a state legislator. And he became county judge when he was 24, 25 years old. And by the time he was 40, he was the mayor of Houston. A remarkable individual.

Hofheinz and Smith were actually trying to build shopping centers. They were very interested in catching up in the craze of malls that was sweeping the country. And they were well aware of the success of the Gulfgate Mall, which had just opened very recently. They proposed a huge mall on a site just north of the present-day Galleria on land that two of them owned. And it would have been revolutionary because it would have had a 1,600-foot completely enclosed mall.

Quite unusual at the time. Most malls in those days were actually open air with the stores facing each other open to the sky. This would have been completely enclosed. And this is what really got Hofheinz interested in domes and air conditioning.

So Hofheinz, like Walter O'Malley, collaborated with Buckminster Fuller for a way to construct that mall. But at the time that serious discussion started about the Dome Stadium in Houston, the architects on the job were the two firms that I told you about before. This is Si Morris, who was the leader of that joint venture. And Si Morris found himself in a meeting one night in the summer of 1960 with Judge Hofheinz. And Hofheinz said, I've concluded that no one's going to come to baseball games in Houston if they're outside. No one's going to come and slap mosquitoes. No one's going to sit and broil in the sun. We have to have a completely enclosed baseball stadium. And he said, can you do it?

Now, Morris did what any sensible person would do. He kind of hemmed and hawed. Well, that's a very interesting idea. We'll be glad to look into it and get back to you. And Hofheinz said, if you can't do it, I'm going to hire Buckminster Fuller. And that was it. No architect's going to want some fancy architect from out of town to come in and tell him what we do. So he said, we'll do it. And that's the decision that was made.

And a couple of months later, the project was announced in the press. And the site was announced in the press. And the project was off. A model was constructed. And Hofheinz took that model to a meeting of the National League owners in Chicago, October 1960. And Houston was finally on the baseball map.

So that new stadium had to be financed. It was a public facility. So it was necessary to have a bond issue. And that became quite a political exercise as the Astrodome is today.

So these are some of the political cartoons that appeared in the newspapers at the time. The press very, very supportive for the most part of the new domed stadium. Most members of the public supportive. Some not so much. Some saw it as kind of a boondoggle for wealthy fat cats. And here you see some of the opposition. Full-page ads in the newspaper from the opposition. Full-page responses from Hofheinz and the Sports Authority.

But the bonds passed in 1961. And it would take two bond issues. One, this one in 1961. And a second one in 1962 to come up with enough money to build what is now the Astrodome.

So, how do you go about making a room big enough for a baseball game? Well, the architects reached out to firms that basically had enough experience to design what needed to be about 600-foot span. Remember all those buildings I was showing you with 300-foot spans? Needed at least 600 feet to span a baseball field and the grandstands to watch the game. So they reached out to these firms that were in the business of building big rooms such as gymnasiums, such as churches, such as aircraft hangers.

So here's one of the proposals they got from Kaiser Aluminum, who was in the dome business. Here's another proposal from a company that built aircraft hangers, that you might see the old, the cable stay aircraft hangers. And this is one of my favorites. This is from a company that built churches with wooden trussed roofs. They proposed to build what is now the Astrodome entirely out of wood. This is a serious proposal. It would have been built out of laminated wood about 14 inches deep, 6 inches wide. Just remarkable, like a huge barn it would have been. And this is a firm that Buckminster Fuller was associated with. They proposed a dome as well.

But the winner for the structure was actually one of the very few non-Texan engineers and architects involved. This gentleman, Dr. Kiewitt from Missouri, was the designer of the roof and the Lamella truss. Lamella refers to the diamond pattern that you see in the roof of the Astrodome. And that's what was built.

Take a look at the roof, what the original plan was here to build, to expose the structure and have a completely glass dome. So you would have seen the structure. And that would have been quite dramatic. But the architects found there'd be great problems with that.

What are the problems? Well, sound and light. And you can see here how they covered those diamond patterns with the smaller square skylights. And that was done to both control lighting and control sound. Put sound control absorption material in between the skylights to reduce echoing. Domes behave very, very erratically and unpredictably with sound. So that's why the Astrodome has 4,596 individual skylights instead of one big glass roof.

So here's an interesting story. This is I. A. Naman. He's the mechanical engineer who did the air conditioning system for the Astrodome. This was a very big deal. I'm really glad that I got a chance to interview Mr. Naman when I was researching the book. He's quite a clever guy because he really had to solve some problems that had never been dealt with before. If you have one big room, you have a lot of special problems. Hot air rises, cold air sinks. So if you plan to air condition the space, you'll end up roasting the people up above and freezing the people down below. So you have to have a way to distribute the air evenly through a vertical space.

Again, no precedent for this. Lots of big buildings, but no individual rooms this big. And it was also quite a challenge to throw the air from the perimeter of the building onto the field. That was important because Hofheinz and the sports administration wanted to have conventions and trade shows in the dome when there was no baseball games. So it was tough to get the cold air, the cool air into the middle of the stadium.

But the biggest challenge was what was one of America's biggest pastimes at the time. That was cigarette smoking. Today, it's kind of amazing to think that you'd have a big building like that where people would smoke. But back in the 1960s, early 1960s, before the Surgeon General's report, was the high water mark of American smoking. About 30% of women and about 60% of men smoked. Inconceivable to have a sports stadium where you couldn't smoke. It was a nonstarter.

So he had to work very hard to find a way to manage all of the smoke inside an enclosed space. Why is that? Well, if you're going to watch a baseball game, you have to watch a baseball. And you have to watch that baseball from as much as 700 feet away. If there's too much smoke, you'll lose visibility. And you can't see the ball. You'll also lose color rendition. So as more and more people light up and the evening goes on, you end up watching the game in black and white.

So Naman designed a sophisticated series of charcoal filters and electrostatic filters to filter that cigarette smoke. It was quite an elaborate design. And this is an ad that the company that designed those filters placed an architectural record in 1965. Go ahead and smoke all 45,000 of you.

He also had to deal with the public opinion. There were rumors circulating in the press that they'd cut corners and there wasn't going to be enough air conditioning and everyone would be very hot and uncomfortable in the stadium. And these were actually showing up in the newspapers, reports that it's not sufficient.

So Mr. Naman, very clever guy as I mentioned, on opening night he cheated a little bit. He went to the engineers in the building. He said, turn that thermostat way down. Turn it down to 67 degrees. That is really, really cold for a public building. And you know what, it worked. He actually had people complaining that it was a little bit too cold in the building.

So now on to the construction process.

And here's where we talk about desegregation. Desegregation in Houston took place very peacefully, thank goodness.

And that was largely because of a series of quiet agreements between African American leaders and white leaders that Houston's public facilities would be desegregated, but it would be done very quietly. And it would be done with no publicity so as to avoid getting people up in arms. And that is what happened. On certain days, African Americans would show up at the lunch counters and would be served. And therefore, Houston had none of the strife that we saw in other places in the South during this period.

That, of course, played into the construction of the Astrodome. Why? One is that Hofheinz, as mayor, had built a coalition of Labor and Latinos and African Americans. And he put that coalition to work getting the bond issues approved. And to accomplish that, he reached out to African American leaders. And an agreement was made that the Astrodome would be desegregated when it was constructed.

So here we see pictures of the groundbreaking. And this is the very famous pictures of the groundbreaking in 1962. Instead of shovels, they used Colt .45s, fired them into the ground. Lots of pictures on the paper of the commissioners and the HSA leadership. Here's a picture. I got this picture on the front of my book. Really a classic picture of all those guys shooting guns.

But look what else happened that day. The African American leaders were invited too. And they participated in the groundbreaking. But you didn't see that picture in the papers. It was all kept very quiet.

So let's talk about the Cold War. Very much a factor. In 1962, we have the Berlin crisis. And President Kennedy got very concerned and actually went on television in July of 1961 and told Americans, you've got to start building fallout shelters. And we, the government, have to find space in existing structures that could be used for fallout.

Now, this was very interesting to the county commissioners and to Judge Hofheinz because what it meant was a lot of federal money available to build fallout shelters. And that meant that federal money could help build the facility. So there was a lot of interest in getting, in adapting the design so that it could serve as a fallout shelter in case of emergency.

Take a look at some of the things that they planned. Here's a section, a cross section, through a portion of the Astrodome. You can see the stands here. And you can see the parking lot outside. They proposed to add an underground level all the way around the Astrodome. Here you see the Astrodome you know today from here to here. And they

would have added this underground shelter like a huge donut underground all the way around the building. Why? Well, of course, when there was a national disaster, it would be available for people to use as a fallout shelter. But here's the good part. On days when there's no disaster, you can park cars there. Or you can have your rodeo, your livestock show there.

So the political leadership was trying to leverage federal dollars to help build the Astrodome. That became quite a political battle. And the Kennedy administration wound up pulling the plug a little bit later. And the decision was made that they weren't going to expand the building like that. Because there just wasn't enough federal money available to make that attractive. But in the meantime, they had dug a pretty big hole to put that building in. And the county commissioners were in kind of a jam. Because they had that hole dug, but they didn't really know that they could afford the building designed to fill that hole.

And this is the commissioner's court during that period. That's Judge Elliott in the center. And these gentlemen really impressed me. Because as I did this research, I waited for the point where they came to this juncture where they didn't think they could afford the building. And I waited for someone to say, well, we'll just have to take the roof off. Because that's usually what happens.

These guys did not do that. They didn't look back. They never considered taking the roof off. They just kept going. And they found a way to get the money to complete the building. So it was quite an impressive display.

And they accomplished that by doing a second bond issue. And that bond referendum was held the Saturday before Christmas in 1962. The second one was $9.5 million. And that equates to about $60 million in today's dollars.

They took hits in the press. People loved to make fun of that hole that they had dug. And it cost $3,200 a week to pump the water out of it. So there was a lot of tweaking going on. It was also called Lake Elliott after the county judge.

So, now let's talk about grass. And people asked me, what's the biggest design challenge in building the Astrodome? It was actually getting grass to grow inside. That was the issue that they spent most of their time dealing with.

And this architect, this gentleman, Ralph Anderson, one of the architects on the team, quite a remarkable guy, veteran of the Battle of the Bulge,was the guy in charge of making it possible to grow grass inside the building. And he ran a little R&D operation of mechanical engineers, scientists, and architects, trying to get just the right relationship between the glass and the rest of the building to have grass grow.

Now, why is that a big deal? Well, we have some skylights on the roof. We need fewer skylights, though, for acoustics, for the reason I explained to you before. And fewer skylights for the sake of air conditioning so the building doesn't heat up too much. But growing grass takes more sunlight. So they had to get the amount of sunlight just right. And there was no model to go by because no one had ever tried to grow two acres of grass indoors.

So the architects quickly decided, well, you know, we've got to make artificial grass. But there was no such product in the market in 1961. AstroTurf was years in the future. So they actually tried to design their own artificial grass. And they sent this around to carpet manufacturers and tried to get them interested. And the carpet manufacturers, we can build this.

So they went on and tried to build to find a way to grow grass. They looked at very sophisticated ways of controlling the sunlight inside the stadium. Giant merry-go-rounds, movable shades, devices that would turn the, that would provide shade at certain times and then sunlight at other times. They thought about building the roof out of a huge Mylar balloon like this Echo satellite. It was a Cold War satellite at the time.

So they went through a lot of really crazy ideas. But before we conclude that they were crazy, take a look at what routinely goes on today. Now here's a randomly selected Major

League Baseball stadium. It has a retractable roof. They don't, they, like most facilities these days, they didn't try to grow grass indoors. They moved the roof back so the sunlight can get to the grass. This is where the Super Bowl was played last year, not last month but last year. And take a look at this. This field slides in and out of the building on rollers, on giant, it's like a drawer. You pull it out and it sits outside and grass grows outdoors and then when it's game day, you slide it in. So they go to extraordinary lengths to have natural grass indoors.

The architects of the Astrodome commissioned studies at Texas A&M. They looked at, they built a little greenhouse that you see here. And they put air conditioners on the side of it and skylights on the top. And they made note of how well the grass grew. They did this for two summers in 1963 and 1964, trying to find the right grass. But they didn't have much luck.

The scientists at A&M said, well, you'll get grass but it's not going to last too long. But it was too late. They were really committed. They had to find a way to grow, they had to go ahead and go with a grass surface in the stadium. So we'll see how that panned out in a few minutes.

So in opening night or opening week, we finally got a look at what it would be like to play baseball under 4,500 skylights. And what, take a quick detour here and talk about one of the things that they did to those skylights. A big problem with having a structured roof is the pattern of shadows that that will cast in the sunlight. And that's bad because it's very distracting on the field and also wouldn't let the grass grow evenly.

So the architects were pretty clever. And what they did is they put diffusers on those skylights. And you can see a prismatic diffuser just like that in this room. And what that does is it takes the light and scatters it and distributes it very evenly. But it has another effect. It enlarges, it tends to enlarge the light source as you look at it.

Why did that come into play? Take a look at the success here. This side of the building under construction has no diffusers yet. This side has the diffusers, no shadows. Mission accomplished. It was a tremendous success.

But if we take a look at this photo taken just before opening day, you can see what the problem is. Those diffusers create a lot of glare. And they take the sun, they basically expand it. So you can't look at the roof without squinting. It's like looking directly at the sun.

So at the end of spring training in 1965, the Astros head north from Florida. And they come and they have their first workout in the Astrodome. But they start to run into trouble. They're having trouble tracking fly balls in the roof. The ball goes up, you lose it in the sun. You can't see it.

And they spent that first afternoon trying to deal with this and running around trying to chase baseballs and not having much luck catching them. At night, the problem went away. No sun, dark roof, everyone saw the baseball, everyone had a perfectly good game.

So take a look at the press headlines the next day. The press always very supportive. Well, it's great for night games.

And they actually went on to blame the victims. They said, oh, yeah, the ball players are complaining about it. But they're always critical. So don't worry about that. Everything's going to be fine.

The next day, they tried sunglasses. All the ball players were given sunglasses to see if they could be able to track the fly balls by wearing sunglasses. And once again, they found that they couldn't do it. And it was really quite terrifying.

This is, you know, this picture is kind of funny when you look at it. But my intention is not to make fun of the ball players because the point of fact, put yourself in their shoes. There, somewhere 200 feet above them, is a very small, hard object heading towards them at, you know, 100 miles an hour. There's no one in this room who wouldn't flinch in that situation. It was really dangerous.

And the Astros started to wear their batting helmets in the outfield. So now the press wasn't so good. Now everyone was saying, this is a real problem.

And this is one of my favorite headlines from my research. They also looked at coloring the baseballs so that they would stand out better. And they tried orange, they tried red, and they tried blue. Nothing worked. The sun's just too powerful.

This is Life Magazine from later that month. Everyone started talking about it across the country. Johnny Carson making jokes about it. And people started to write in letters with complaints. These are all actual suggestions that were made from people who wrote letters to Judge Hofheinz and the Sports Authority.

So a solution had to be found pretty darn quick. And what they did was they realized if they whitewash the roof like a greenhouse, that's going to cut down on the glare. And look at the contrast between that panel that had whitewash on it and all these other panels you couldn't possibly see. And that's actually the way they solved the problem. In late April of 1965, they sent guys up onto the roof and they painted every single of those 4,596 skylights.

And that solved the glare problem. However, it caused other problems.

Let's take a look inside. And I'm sure a lot of you remember this, the elaborate costumes that the employees wore. I just love this picture. This is a great picture. All of those uniforms were designed by a costume designer who worked in opera. Everyone who had a front line customer service position wore a uniform like this, all space themed.

The scoreboard was revolutionary for the time. Pretty primitive by today's standards, but it was quite remarkable at the time. Each individual bulb program, not a matrix like you see in sports stadiums today. And the AstroVision screen, which is really quite remarkable.

And this, you know, looks like a television, but it really doesn't work that way. In the back of the house, you'd have these two gentlemen. That's a conventional projector pointing light at this screen, which is a reproduction of the screen that you see outside. You can see the shape. And these are light detecting diodes. And the diodes either on or off. Each one of the diodes connected to the corresponding light on the screen. So it was basically a big shadow box.

And this gentleman's trying to encourage the crowd to clap. And that's what you see outside. Graphics like this were a slide. You put it in a slide projector and pointed at that screen. And that's how these animations were made.

And this became controversial because the opposing team started to take this personally. This is a pitcher getting pulled out of the game to the showers and he ends up drowning in the shower. So there's a lot of complaints about this.

And I'm sure all of you know about the lavish interiors, the Presidential Suite, the Astrodome Club, the Sky Dome Club. Very, very lavish interiors, as well as the judge's apartment.

Now, this building was a tremendous novelty when it opened. And everyone was kind of looking for a chance to get inside. During construction, they actually built grandstands so that people could watch it being built. And a lot of events were concocted just as ways to get inside the dome.

This is the Boy Scout Jamboree in 1965. Normally a three-day event done in one night to fit it all into the Astrodome in time. Here's a picture of the event. Here you have, it was the kind of event that the Boy Scout next door will come to your door in his uniform and try to sell you tickets. And to be nice, you'll buy a ticket, but you're certainly not going to go. Not to this, everyone who bought a ticket wanted to actually go and sit in this building. So here you have the Boy Scout Jamboree. Here's your son over here tying tourniquets. You're over here, you can't possibly see anything that's going on. Outside, bedlam, 15,000 people turned away at the door. This event was oversold, almost a riot situation. And when the event wrapped up at 9 o'clock, there were still people arriving and driving around the parking lot looking for spaces. Everyone wanted to get inside the building.

The boat show was one of my favorites. Now this is not the Astrodome, but I put this in because not everyone has been to a boat show. Typically you have the boats on the floor, you have people walking around. You can walk up, you can take a close look at the boat, you can climb up inside the boat, decide whether you want to buy it, see how it feels. Here's the boat show at the Astrodome in 1966. Of all the boats down in the bottom, people up in the stands sitting in their seats looking at the boats. You couldn't walk around, but it didn't matter. They just wanted to be inside the building.

That's how, that's what a novelty it was to sit in this, to sit in this, and they all paid. They paid for tickets just to sit there.

And of course, as I'm sure all of you know, tours of the Astrodome continued for years, and the Astrodome was one of the biggest tourist attractions in the United States.

So, let's talk about AstroTurf. Judge Hofheinz called it Undertaker's Grass after the artificial grass that they would pile on the exposed earth and grave sites. As you recall, the roof of the Astrodome painted in April 1965 solved the glare problem, but it caused the grass to die. And for the rest of the 1965 season, the Astros had to paint the dirt, paint the dead grass green. It's absolutely true, because the grass, all the grass died.

So now there really had to be a solution to produce artificial grass. And fortunately, there was a solution coming.

AstroTurf was not invented for the Astrodome, and it wasn't even invented for sports teams. It was actually a social program, and it was instituted by this think tank, Educational Facilities Laboratories, associated with the Ford Foundation. And these folks were trying to find ways for innovative approaches to school facilities. So they gave us modular classrooms, open classrooms, language labs, all this cutting edge stuff from the 1960s. And it was the think tank that came up with artificial grass.

Why? Inner city schools didn't have grass. The playgrounds in the inner city schools, generally asphalt, sometimes on the roof of the school. And the educators saw that as unfair. They said, why can't we have a playground in downtown Manhattan that's just like Scarsdale? So it was kind of a social equity issue.

And they allied with a company called Chemstrand. Chemstrand was in the business of producing artificial fibers and really mostly trying to sell clothing. At the time, artificial fibers coming into use in clothing, and it was a very profitable market. So this company was in business to make artificial fibers for clothing and carpet. And that's how they came into the picture.

They finally managed to make a ribbon of nylon that was durable enough to stand up straight and produce a grassy surface. This is a private boys' school in Rhode Island in 1964, where the first artificial grass was installed. They called it Chemgrass. That's what it was originally called.

And they were introduced, that company was introduced to Judge Hofheinz and the ownership of the Astros. And a deal was quickly struck to install artificial turf in the Astrodome.

Here's the infield installed in the beginning of 1966, about 50 years ago. There was not actually enough material produced to make an outfield at the beginning. So they had the infield first, and then finally they rolled out the outfield later in the season. And that, of course, became an iconic image of sports in the 1970s and 1980s.

Everyone wanted AstroTurf in their stadiums. It was, and everyone built AstroTurf in their stadiums. About 40% of Major League Baseball games by the end of the 1970s, beginning of the 1980s, were played on AstroTurf.

But times changed. In the 90s, we started to see a retro movement in baseball park design. This is Camden Yards in Baltimore. This is a stadium. You recall that I showed you the completely symmetrical baseball stadium of the 1950s. This one was deliberately asymmetrical. It was deliberately introduced these nooks and crannies and irregularities because that was the retro look was coming back into vogue.

And Houston, of course, replaced the Astrodome with a facility much like that. Deliberately asymmetrical. Lots of ins and outs and hills and ups and downs. And in fact, Minute Maid Park is more like Ebbets Field than it is the Astrodome. So tastes very much changed in the 1990s. And, of course, the Astrodome hosted its last baseball game in 1999.

So I want to close by showing you this picture again of the architects and the engineers working on the domed roof. And I've talked a lot about them today. And I've told you a lot about their mistakes.

But I have to close by saying how much I admire these architects. These gentlemen really set out to do something that had never been done before. And, of course, they made mistakes. It was unprecedented ground.

And that's actually why I've dedicated my book to the architects and engineers who built the biggest room in the world.

And that's the end.

Thank you very much.

I have some books for sale. But if you don't want to stick around, you can get them at Amazon or at the Brazos Bookstore.

Thank you all.