The 24 foot high retractable doors raise to allow all acoustic tiles to be stored in the ceiling. The 30 foot waffle slab roof structure supports the entire load of the kinetics and allows natural light.

Kinetic Morphology of Performance Space
An Architectural Design Thesis by Matthew Robert Dunham
Thesis Statement

Technology-integrated architecture in the morphology of high-profile performance venues for maximum flexibility.

*To clarify terminology used in this presentation, the term performance space denotes all artistic and stage related performance venues with capacities of 500-38,000 observers.*
Introduction

Typology
Multiuse performance venue.

Claim
A venue which transforms to accommodate all conceivable event typologies will have a longer life span, facilitate more events and visitors, and be a prototype for future buildings.

Premise
Transforming performance venues demands high end technology integrated architecture to maximize full potential flexibility.

Unifying Idea
One space which can be used to host gatherings of 250-30,000 people. A single space which morphs to create separate spaces within the whole, bringing all arts together to share one space.

Need
One large performance venue which has multiple artistic typologies where it is digitally flexible to accommodate acoustics, lighting, pedestrian circulation, and service needs.

Justification
These existing large venues have a high cost and energy consumption. However, by combining multiple typologies under one roof, it becomes a one-stop-shop destination, minimizing costs, consolidating resources and compounding income.
Twelve on-site visits were conducted.

Each site was chosen specifically for being an extraordinary performance venue, which exhighs flexibility, state of the art technology and ingenious engineering.

Cirque du Soleil, Ka, Las Vegas
Caesars Palace Colosseum, Las Vegas
Le Reve, Las Vegas
Orpheum Theater, Minneapolis
Willow Creek Community Church, Chicago
Wyly Theater, Dallas
University of Phoenix Arizona Stadium
Dallas Cowboys (AT&T) Stadium
Target Field, Minneapolis
Winspear Opera House, Dallas
The Site

- Dallas, Texas, USA
- Longitude -96.75 and Latitude 32.77
- Dallas Population: 1,241,162
- Metroplex Population: 6,371,773 people
Situated 2.3 miles due east of downtown Dallas, Texas. The site selected is currently a large vacant parking lot which is used only several times a year for varying events. The dimensions are 840.33' x 1845.5'.
Situated 2.3 miles due east of downtown Dallas, Texas.

DART: Dallas Area Rapid Transit Train line near by site.

Located off of Interstate 30 and 45.

Service track for train deliveries.
Summer Solstice
Winter Solstice
Vernal Equinoxes
Zenith
Horizon

81°
Winter Solstice
31°

Sun Angle: Summer and Winter

Zenith

Sun Angle: Equator Summer and Winter

Sun Diagram
The Solution: The Kinetics

Part One
Kinetic Elements

There are 586 kinetic components.

208 Floor segments. 224 kinetic walls. 153 Acoustic components.

This kinetic morphology happens through the use of hydraulic lifts, push chains, spiral lifts, suspended track systems and electric winches.

The floor is divided into segments and can be raised and lowered 24 feet as needed.
Kinetic Elements

The entire system, other than the floor, is ceiling suspended and retracts into large loft-level garages.

The system is designed to be exclusively automated therefore requiring less man hours and intensive labor.

Through an inferred and motion detector system, kinetic objects will not engage if people or objects are in the way or in danger.
Animation

4:55 Minutes
Common Kinetic Variations

The six most common variations; stage size is based off of kinetic floor segments and walls are dictated by tracks in the ceiling. Maximum capacity is 10 separate stages.

- **Stage**
- **Wall Divisions**

### Divisions: 0
- **Typologies:** Large Concerts
- **Capacity:** 38,000-51,000 People
- **Kinetic Complexity:** 0
- **Zones:** 1-4
- **Stages:** 1

### Divisions: 2
- **Typologies:** Large Events
- **Capacity:** 30,000+ People
- **Kinetic Complexity:** Minimal
- **Zones:** 1-4
- **Stages:** 2
Common Kinetic Variations

The six most common variations; stage size is based off of kinetic floor segments and walls are dictated by tracks in the ceiling. Maximum capacity is 10 separate stages.

- Stage
- Wall Divisions

Divisions: 6
Typologies: Theater
Stages: 4
Capacity: 8,000 People
Kinetic Complexity: Medium
Zones: 3 & 2

Divisions: 4
Typologies: Orchestra
Stages: 4
Capacity: 15,000 People
Kinetic Complexity: Minimal
Zones: 1 & 4
Common Kinetic Variations

The six most common variations; stage size is based off of kinetic floor segments and walls are dictated by tracks in the ceiling. Maximum capacity is 10 separate stages.

- Divisions: 5
  - Capacity: 10,000 People
  - Typologies: Mixed
  - Kinetic Complexity: High-Medium
  - Stages: 5
  - Zones: 1-4

- Divisions: 10
  - Capacity: 24,000 People
  - Typologies: Mixed
  - Kinetic Complexity: Complex
  - Stages: 10
  - Zones: 1-4
The proscenium arch is set right at the base of the seating slope.

The proscenium arch is set back 7 floor segments allowing additional orchestra level seating.
The Solution: The Building

Part Two
Building Section
The design demanded a structural roof which would span 480 feet, allow light to permeate inside and provide a 100% accurate flat base. Industry standard long span trusses were bypassed as they do not guarantee a flat bottom rail.
Floor Plan Level 2: Sub-Service

On this level: Loading dock, Substage hydraulic floor, Kinetic Control Booth, Mechanical, and Access to all stair and elevator vertical circulation cores.

42 Kinetic Control Booth
43 Substage Hydraulic Lift
44 Loading Dock
45 Mechanical
South Fitzhugh Avenue

Floor Plan Level 3: Ground Level

1. Visitor Car Drop Off
2. Visitor Ground Level Lobby
3. Staff Entrance
4. Staff/Visitor Covered Parking
5. Retail/Restaurant
6. Staff/Volunteer Covered Parking
7. Staff/Volunteer Parking Entrance
8. Staff/Volunteer Locker rooms
9. Staff/Volunteer Event Briefing Room
10. Public Entrance to Service Corridor
11. Security Headquarters
12. Medical Center
13. Event Management Office (Ground Level)
14. VIP Performer/Guest Underground Arrival
15. VIP Motorcade Parking
16. Mechanical
17. Entrance to Performance Arena
18. Dressing Room/Green Room Suite
19. Locker rooms
20. Kinetic Wall Storage Room
21. Kinetic Wall Maintenance Room
22. Common Arrangement for Small Theater
23. Common Arrangement for Corner Concert Hall
24. Common Arrangement for Large Theater
25. Main Performance Arena
26. Rehearsal/Warm-up Rooms
27. Laundry/Storage
28. Press Entrance
29. Trade Show/Storage Room
30. Ramp down to Level 1 (Loading Dock)
31. Service Dispatch Kitchen
32. Vehicle Arrival
33. Vehicle Departure
34. Parking
35. Visitor Bus Parking
36. Entrance to Underground for Semi-Trucks/Loading Dock
37. Entrance to Underground for VIP/Motorcades
38. Public Green Park
39. Ramp up to Colonnade Level 2
40. Fair Park
41. Dart Metro Transit Station

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Floor Plan Level 3: Ground Level
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Floor Plan Level 4: Concourse

On this level: Lobby and main doors 1-4, concourse, exterior colonnade, concession/bars, restaurants, and bookstore.
Floor Plan Level 5: Administration

On this level: administrative offices, conference rooms, support offices, and restaurants. This level is bypassed by the main escalators, Accessible by elevators and stairs.

47 Restaurant

50 Administrative Offices

51 Meeting/Conference Rooms
On this level: administrative offices, conference rooms, support offices, and restaurants. This level is bypassed by the main escalators. Accessible by elevators and stairs.
On this Level: Direct connection via escalator and stairs, this gallery level provides access to first balcony rows 1-15. This floor allows full circular circulation through all four sections of the building if necessary.

47 Restaurant/ Lounge

52 Balcony Lobby Space
Floor Plan Level 7: VIP Suites/Conference

On this Level: Rehearsal space, conference and meeting rooms, three VIP greenrooms with direct access to Level 2 and private secure underground arrival via private elevators for each suite.

47 Restaurant/Lounge
53 VIP performer and Guest Suites
54 Press Room
55 Meeting Rooms
Street View
Exterior Colonnade
Outside Door 3 at Night
Administration Offices
Typical Theater Space Configuration
Full Performance Space