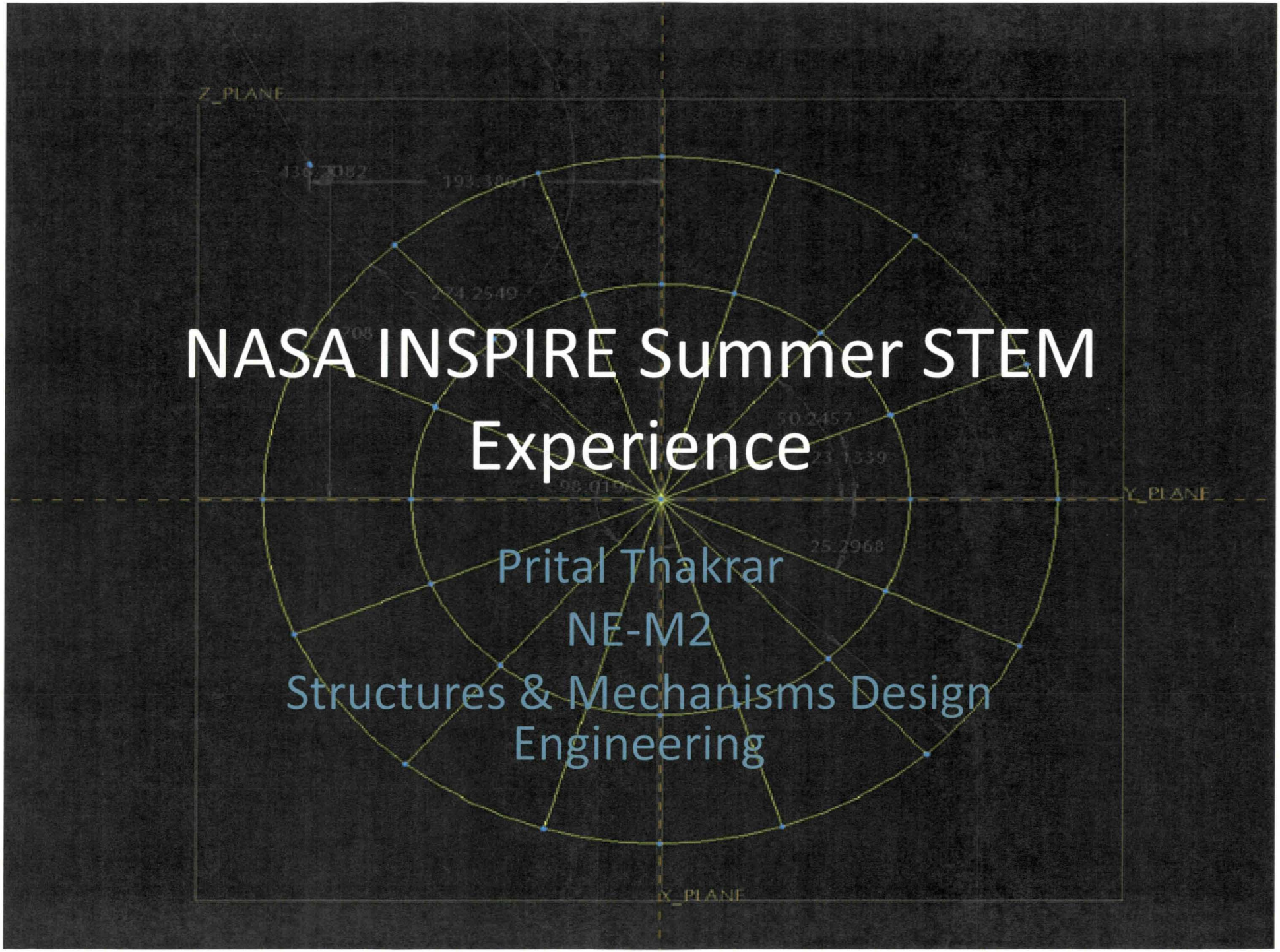


NASA INSPIRE Summer STEM Experience

Prital Thakrar
NE-M2
Structures & Mechanisms Design Engineering

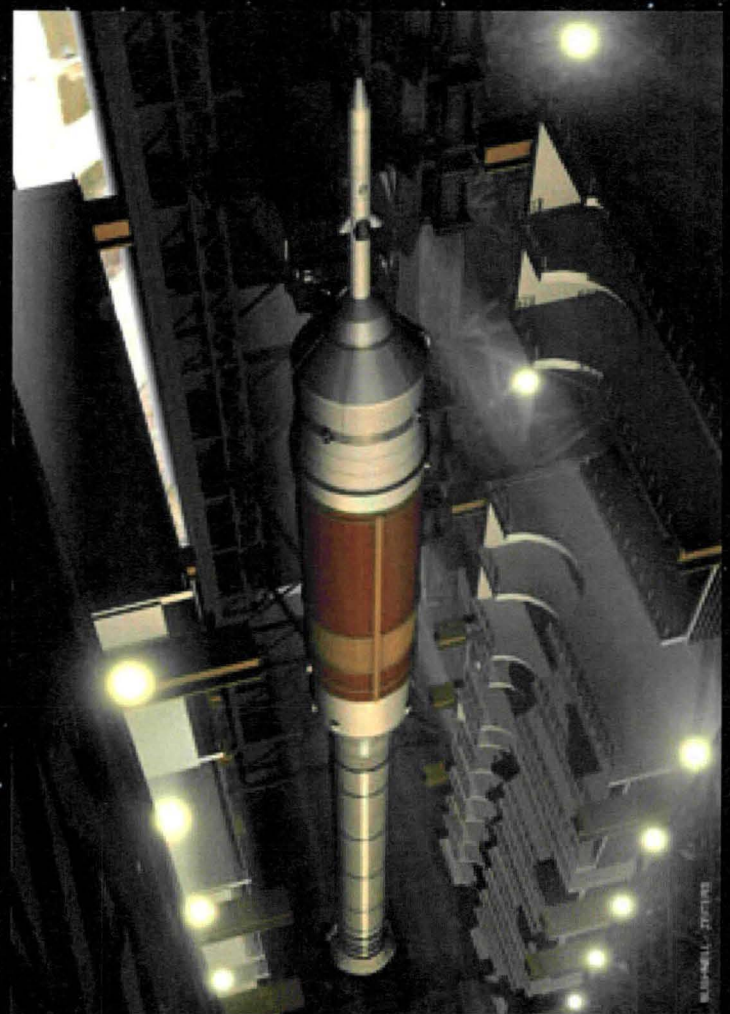
The ARES I - VAB Platforms

Project Definition:

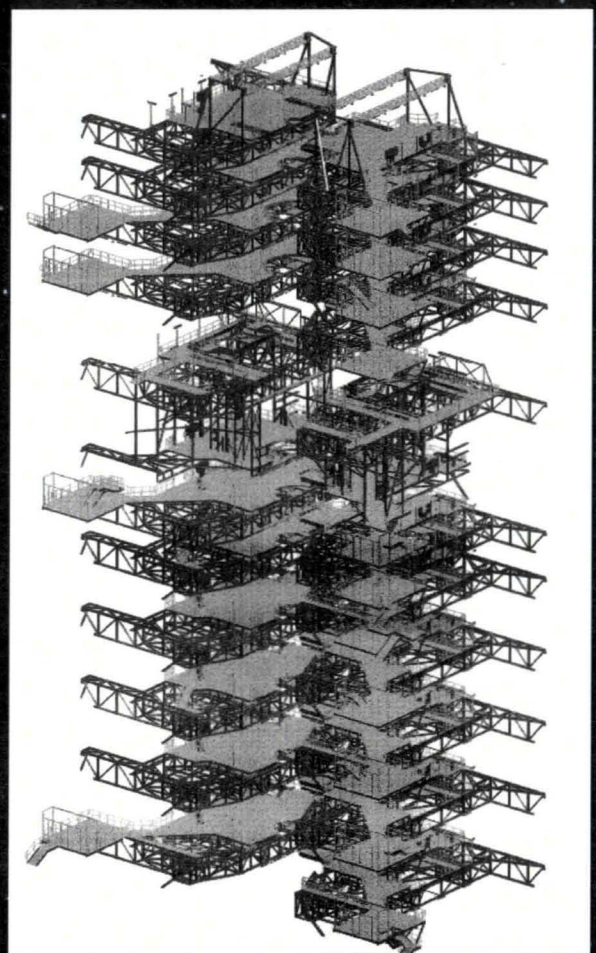
New VAB platform design has sliding platform pairs that meet at the rocket in the middle of the VAB. Cantilevered platforms can deflect unevenly under load.

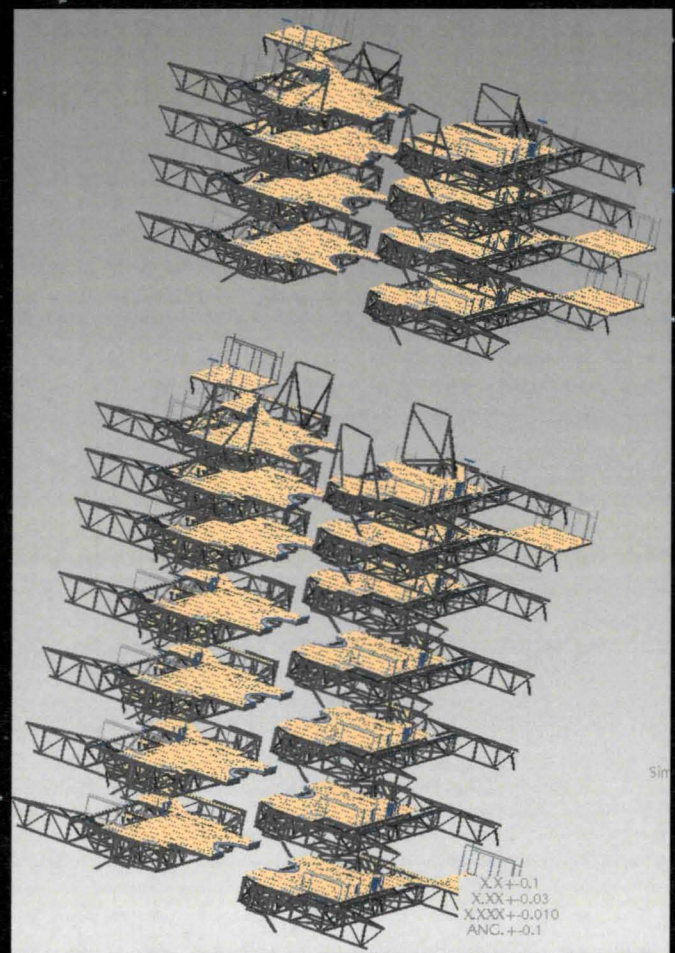
Assignment:

Modify VAB platform design to allow load sharing between platforms and prevent tripping hazard when ends deflect under load.



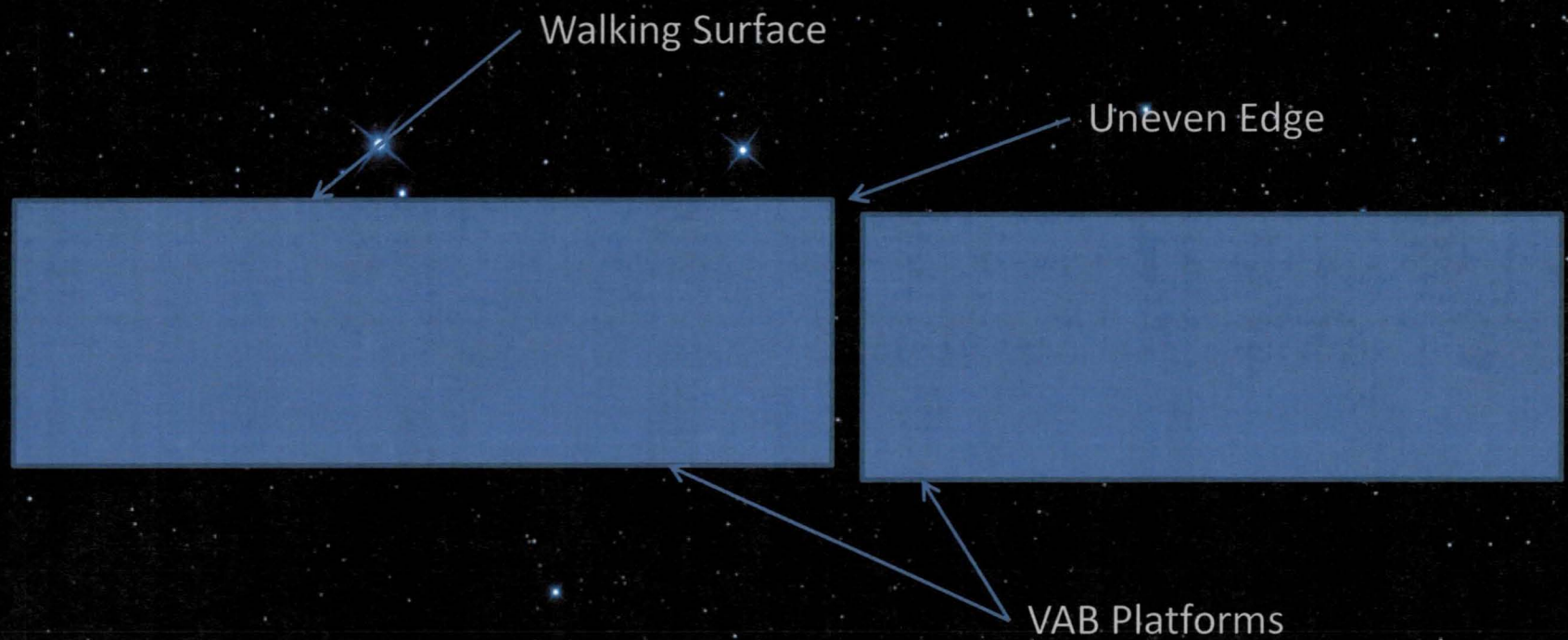
VAB Platforms (cont'd)





11 Platform Pairs designed by a NASA contractor, but not fabricated

The Issue



Platform Pair Side View

Initial Schemes

1. Forced pin / receptacle (if drive system permits)
2. Alter drive system to use #1
3. Use an actuator to activate pin
4. Use a lever to activate pin

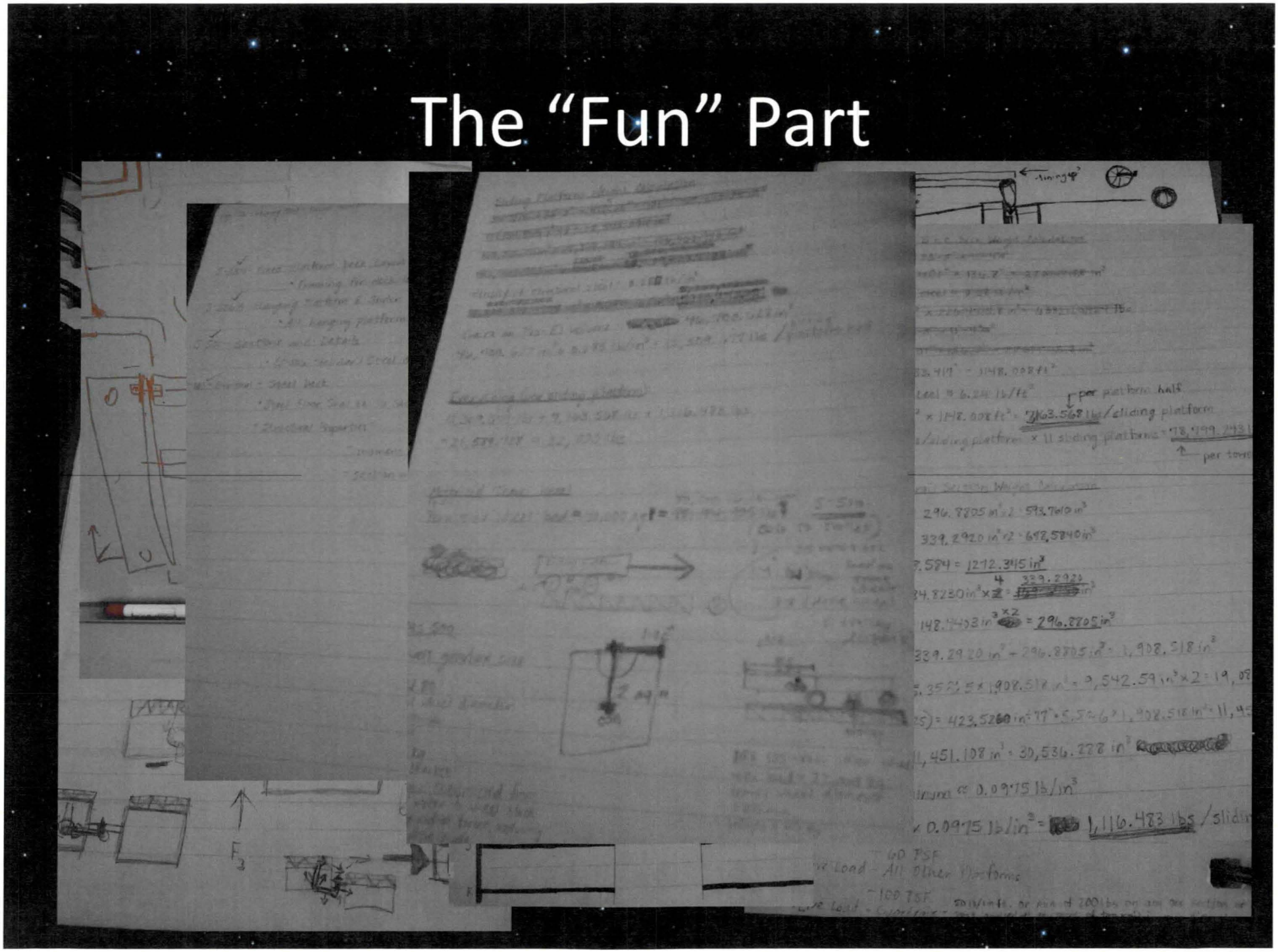
Preliminary Work

1. Find VAB platform drawings
2. Find platform models
3. Determine which drive wheel actuator was used
4. Find drive actuator vendor technical specifications

Required Calculations

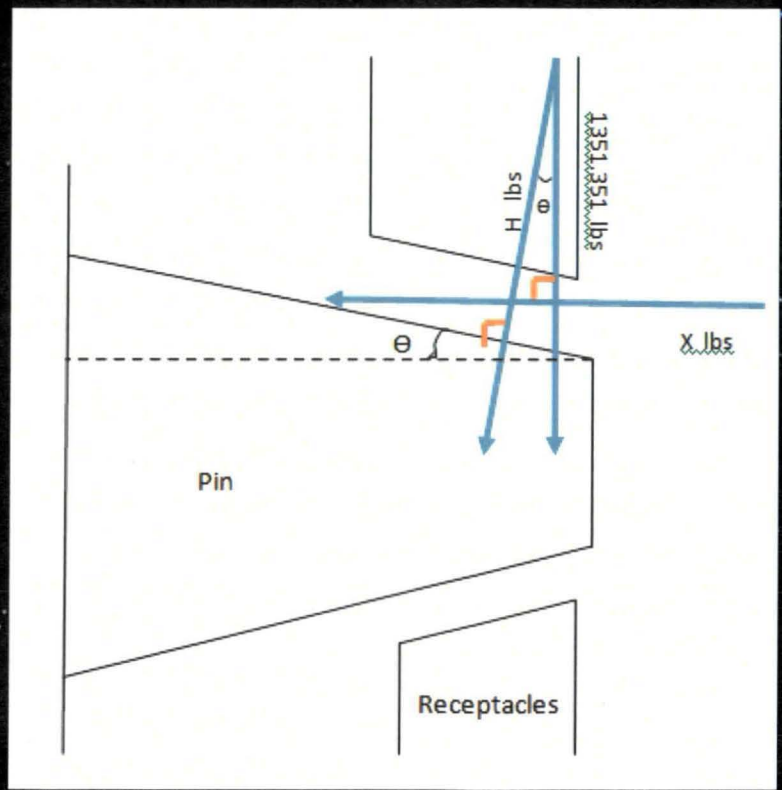
- Weight of One Platform
- Load on Front Wheels
- Total Wheel Slipping Torque
- Total Drive System Torque
- Wheel Slipping Torque < Drive System Torque?
- Tangent Propelling Force From Drive System
- Rolling Resistance Torque
- Total Horizontal Force Available
- Load Required to Lift End of Platform
- Available Load to Use
- Tangent Force
- Perpendicular Force
- Friction
- Total Engagement Load
- Remaining Load
- Pin Length (if applicable)

The “Fun” Part



The Findings

✓Pin method works!

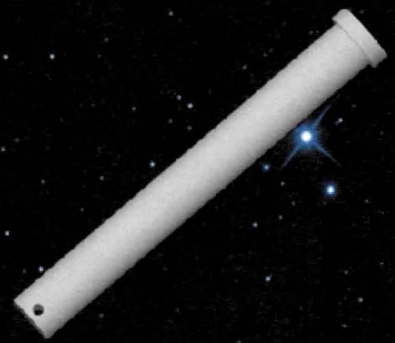


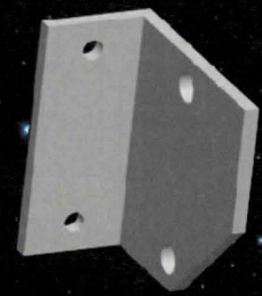
Θ→	5°	10°	15°	20°	25°
Tangent Force	118.2279 lbs	238.2796 lbs	362.0934 lbs	491.8515 lbs	630.1453 lbs
Perpendicular Force	1356.513 lbs	1372.198 lbs	1399.022 lbs	1438.078 lbs	1491.051 lbs
Friction	271.3026 lbs	274.4396 lbs	279.8043 lbs	287.6155 lbs	298.2102 lbs
Total Engagement Load	389.5305 lbs	512.7192 lbs	641.8977 lbs	779.4671 lbs	928.3555 lbs
Remaining Load	2110.47 lbs	1987.281 lbs	1858.102 lbs	1720.533 lbs	1571.645 lbs
Length of Pin	5.715026 in	2.835641 in	1.866025 in	1.373739 in	1.072253 in

Calculations show that the actuator is capable of driving pins into sockets, locking the platforms ends together

The Solution

Roller Receptacle Assembly

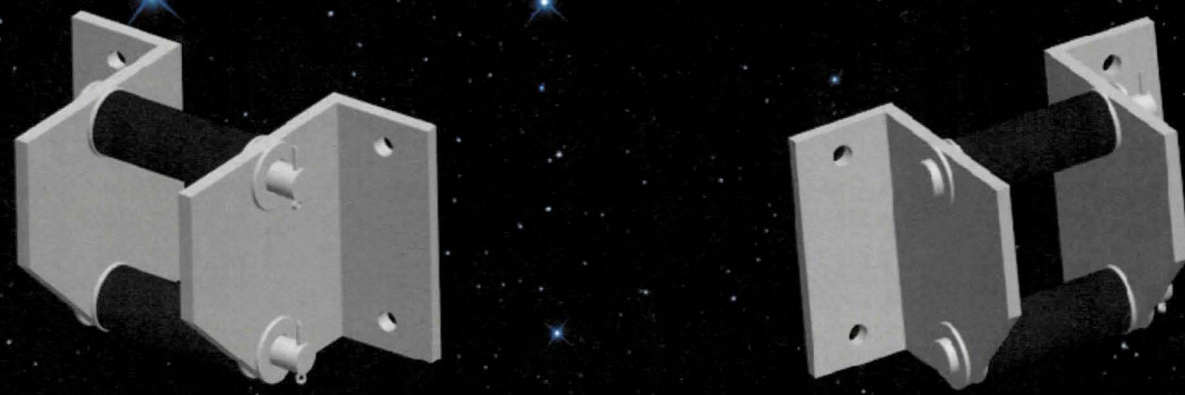




Parts modeled in Pro/E 3-D CAD software

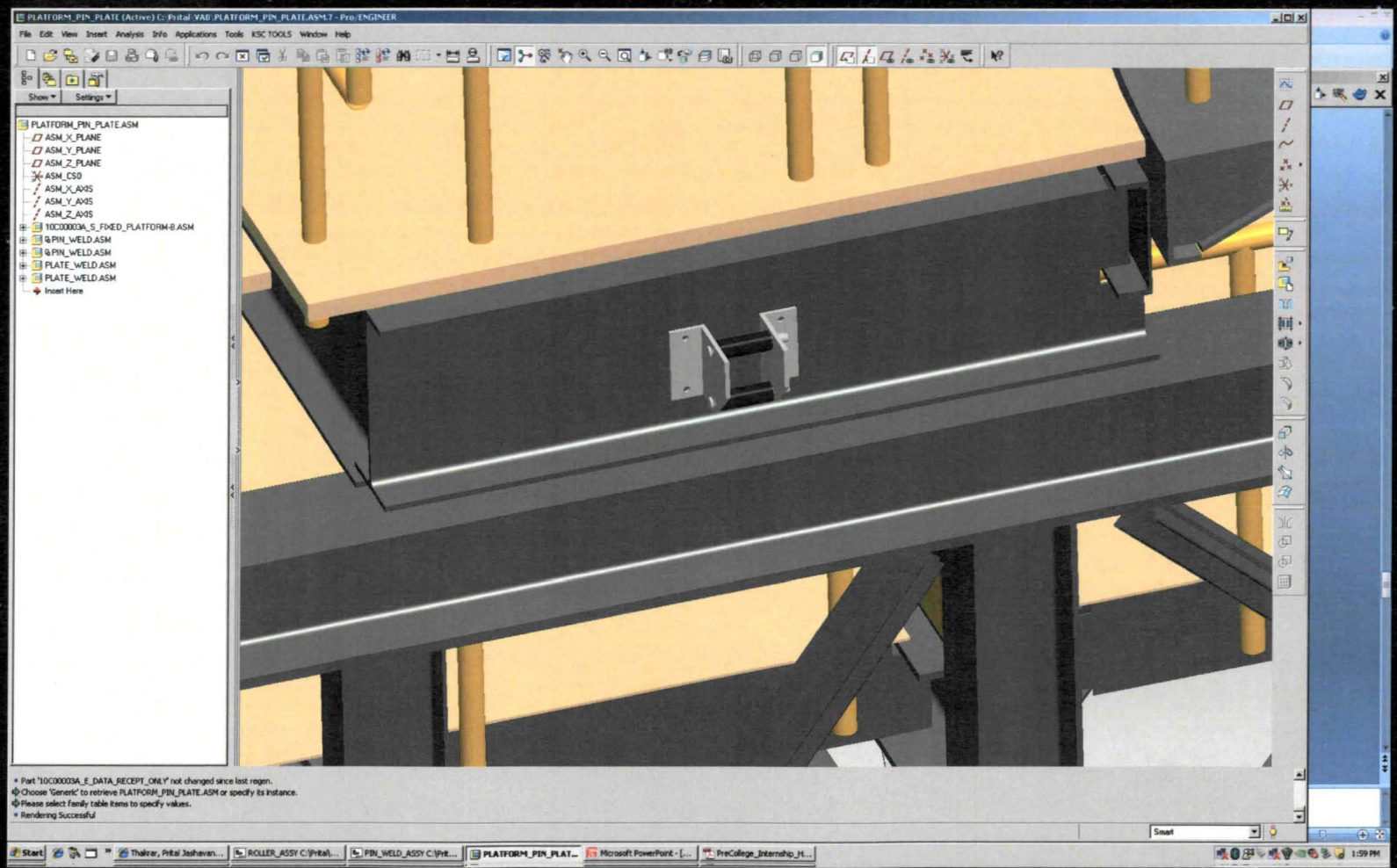
The Solution

Roller Receptacle Assembly (cont'd)



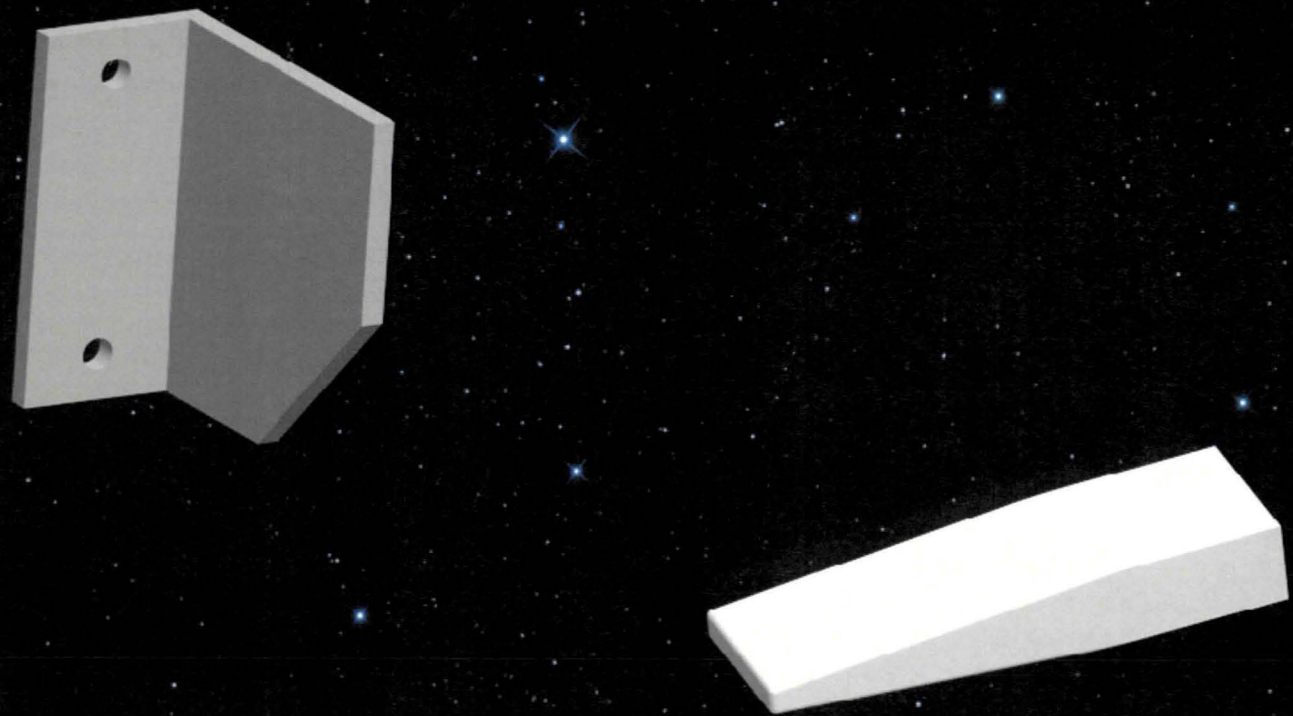
The Solution

Roller Receptacle Assembly (cont'd)



The Solution

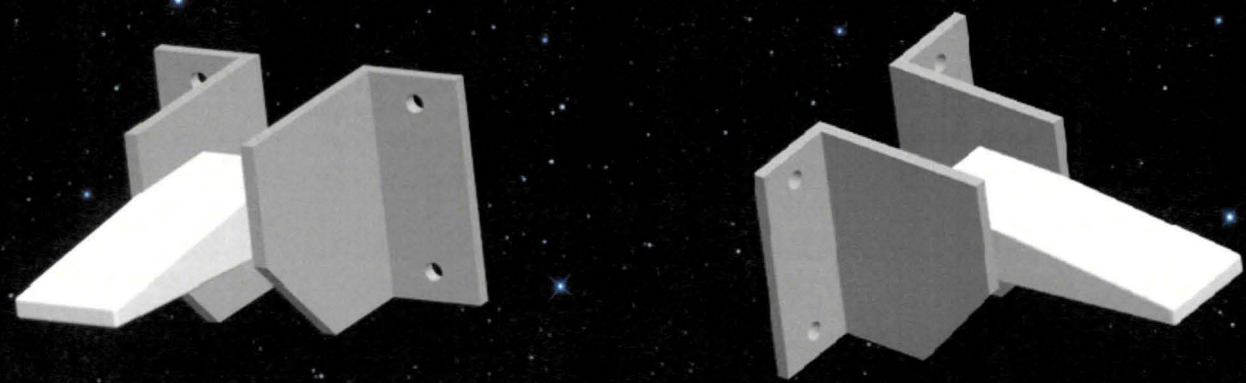
Pin Assembly



Parts modeled in Pro/E 3-D CAD software

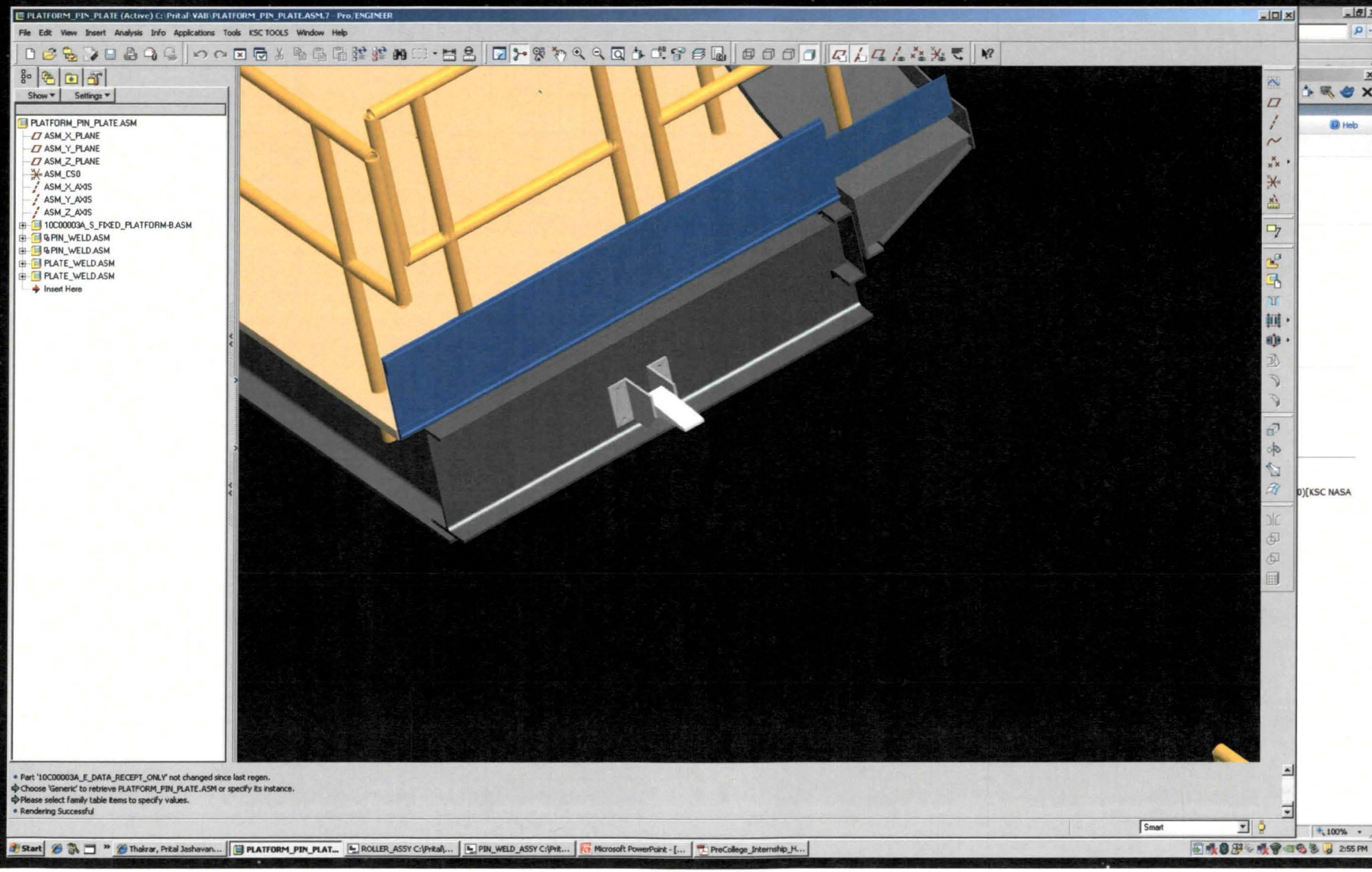
The Solution

Pin Assembly (cont'd)



The Solution

Pin Assembly (cont'd)



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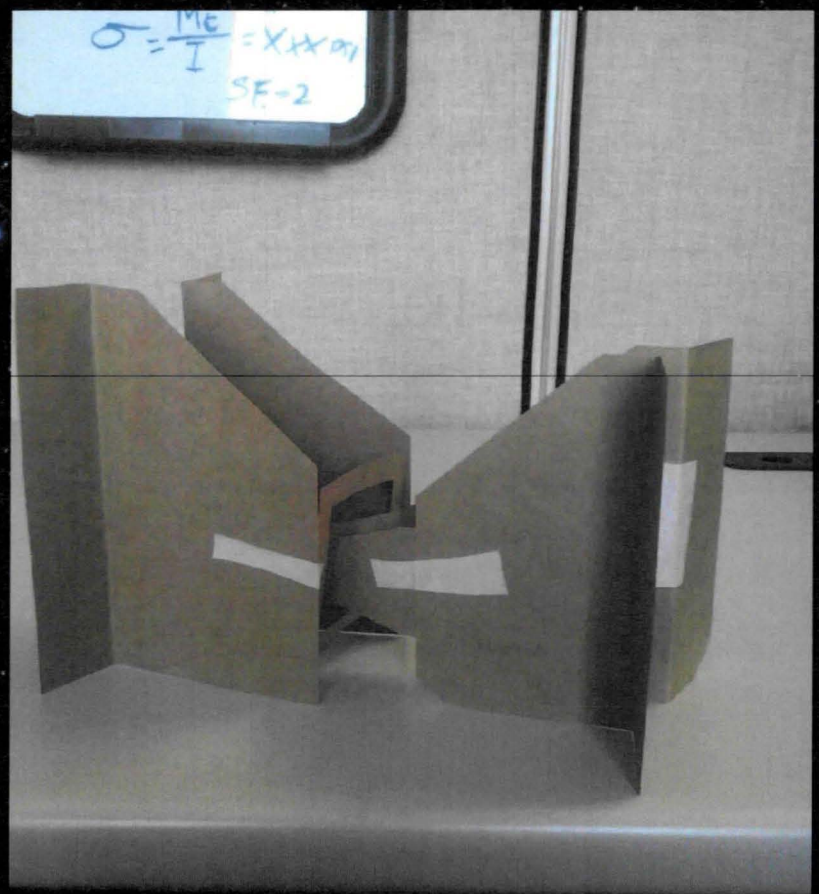


Cardboard Prototype of Pin Mechanism

The Solution (cont'd)

Side View of Fixed Platforms and Sliding Platforms with Pin Mechanism

The Solution (cont'd)

✓Pros

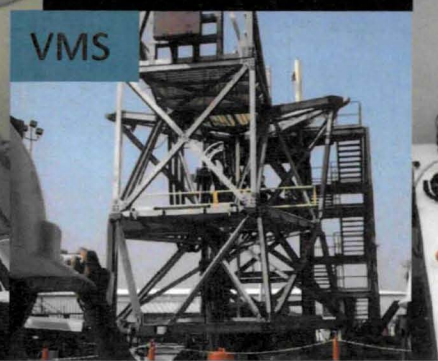
- ✓ *Conservative calculations*
- ✓ *Rollers*
  - ✓ Counters indefinite friction coefficient
- ✓ *Washers*
  - ✓ Avoids scraping off paint
- ✓ *Cost-Effective*
- ✓ *Easily machined*
- ✓ *Simple*
  - ✓ *Fewer breakages*
  - ✓ *Less maintenance*
- ✓ *Load Sharing*
  - ✓ *Reduce weight of platforms*

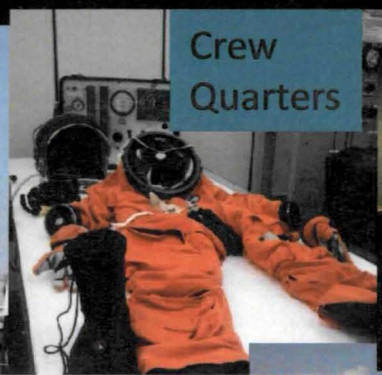
•Cons

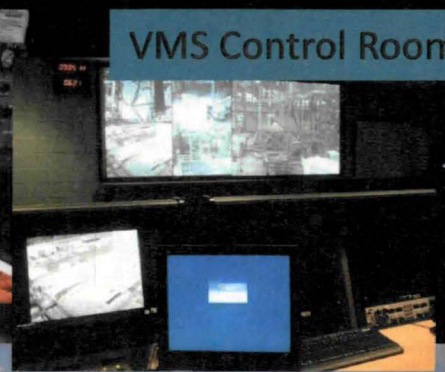
- *Deflection from extensive pin length*
- *Low tolerance on installation position*

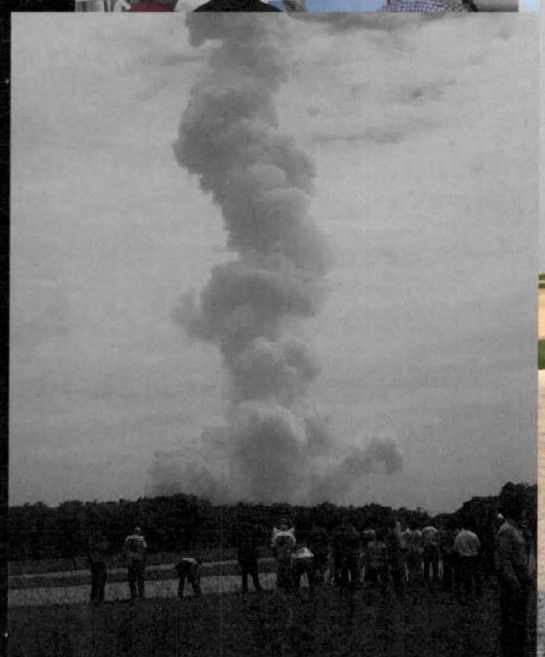
Past the Project

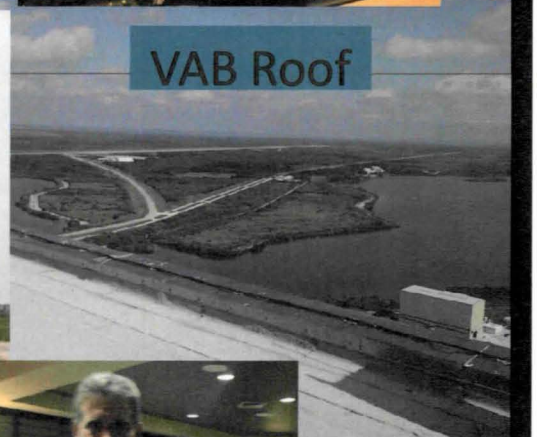
Experience with Mentor & Co-Workers





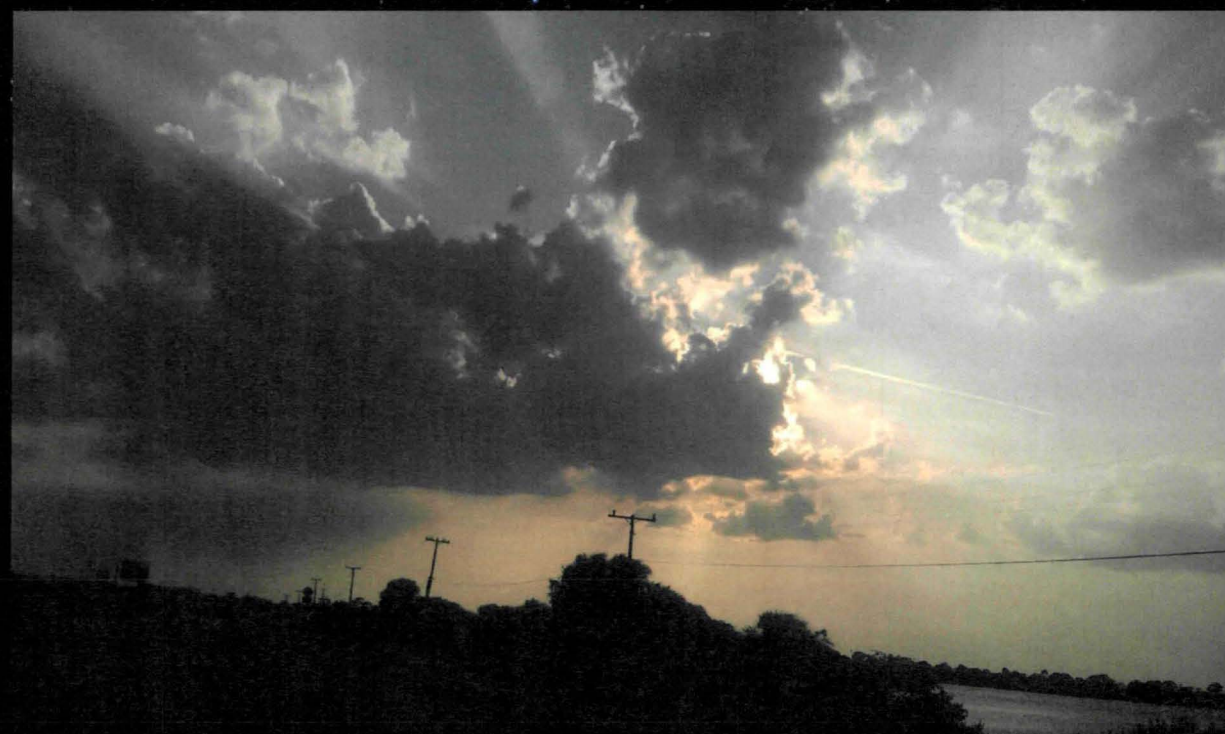






Past the Project (cont'd)

Merritt Island



STEM Experience

Influence & Knowledge Gained

- Confirmed: I Love Physics
- Statics
- Double Major: Aerospace Eng. & Electrical Eng.
- Pro/ENGINEER Wildfire 3.0
- Design process tips

NASA Experience

- Several career fields
- Friendly environment
- Rich history
- Importance of collaboration
- Cooperative Learning Opportunity
- ***Unity***

Future Plans

- Aerospace Engineering & Electrical Engineering
- Applying for Co-Op Program / Internships
- Work for/with NASA & Other Companies
- Continue to Pursue Other Interests
  - Music
  - Public Speaking
  - Tutoring
  - Programming
  - Business

Thank you, INSPIRE!