



Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



AERIAL VIEW OF KSC LAUNCH SHUTTLE COMPLEX





Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC DELMIA SCREEN PROCESS CONTROL LAYOUT



View 1

P.P.R.
ProcessList

- Process to stack Ares-1 into the VAB at KSC
 - Start.2
 - Initial View
 - Initial View
 - Hide CEV_606-BLOCK2_from_CEC606.1
 - Hide Female_P50.1
 - Hide GSE_Dome_Ribs.1.1
 - Hide srbpalletaft.1
 - Show MLP_CX_LA_Integration_CGR.2
 - Hide Catia_V5_srbpalletaft.1
 - Hide KAMAG_SM_CM.2
 - Show CX_LA_INTERGRATION.1
 - Hide cx_ml_lm_sw.asm.1
 - Hide fs_aft_skt_sw.1
 - Hide brep_with_voids_117.1
 - Hide A_LM_Stand.01.1
 - KSC Ground based maps Show Product150.1
 - Hide CX_LA_ARES_I_KSC_A105.asm.1
 - Hide GSE_Dome_1.4.part.1
 - Hide LAS_Transporter_01.1
 - Show VAB_High_Bay_1_2_3_4.1
 - Hide EM000700_Rev_K_cgr_wo_Door.1
 - Show h77_0384_lifting_beam.2
 - Hide JL6_Manned_Platform.2
 - Hide Female_P50_V5_CGR.1
 - Show VAB_Interior_V1.1
 - Show VAB_Floor.1
 - Hide A_New_IU_Ring_Scaffold.1
 - Zoom into VAB
 - Retract VAB_Platforms at all levels
 - Retract CX_Umbilicals
 - Move Launch Mount to MLP
 - Move Aft Skirt and Aft Segment to MLP
 - Move Aft Center Segment to MLP
 - Move Center Center Segment to MLP
 - Move Forward Center Segment to MLP
 - Move Forward Segment to MLP
 - Move Short Forward Skirt_FSE_Frustum Segments to MLP

3.993701 in



Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



DELMIA SCREEN PROCESS CONTROL LAYOUT

View 2

Align Upper Stage to First Stage *****

Start_30

- Hide FA_Trailer.1
- Move_VAB_Crane_325T back on track
- Show_ILG_Manned_Platform.1
- Hide dv01gs-trts9000-001_cgr.1
- Hide Scissor_Platform_120_inches.part.1
- Hide KAMAG_SRB_TRANSPORTER and Fwd Pallet
- Move Tug_Motor.1
- Show VAB_Complete_South_Door_panel_ext
- Hide X_Rotational_axis.part.1
- Hide Start_Stop_marker.1
- Show Female_P50_V5_CGR.1
- Hide 25_x1_Alignment_pin_at_90_on_1st_Stage_#2.part.1
- initial view of the US VAB aisle
- Move_VAB_Crane_325T_Cables back in place
- Show VAB_Interior_Complete
- Show_VAB_Complete_North_Doors ??????
- Move Upper stage and transporter to Pickup point
- Move_ILG_Manned_Platform.1
- Switch views to the Forward end of US
- Move Scissor_Platforms to forward Hookup
- Move A_VAB_Crane_325T-01.1
- Move 325T_Trolley to forward end of US
- Lower Forward Hook to forward US lifting dome
- Allow viewer to see hookup of segment
- Allow viewer to see hookup of segment
- Return Scissor_Platform to Origin
- Hide Scissor_Platform_1_1_8.part.1
- Lift US and support structures up ~10 Feet
- Move Tow Motor and US Transporter out of the way
- Return US and support structures to transfer aisle
- Grab and Attach US stack and Dome to rotation bar
- Switch from Forward to side view
- Allow viewer to see hookup of segment
- View the Horizontal to Vertical break over
- Rotate US and Support structures with the Aft Rotation Rod
- Lower 97M25000_US stack and cables to manned lifts height
- Move_ILG_Manned_Platform.2
- Allow viewer to observe MLP stack

Pallet_001119

3.93701 in

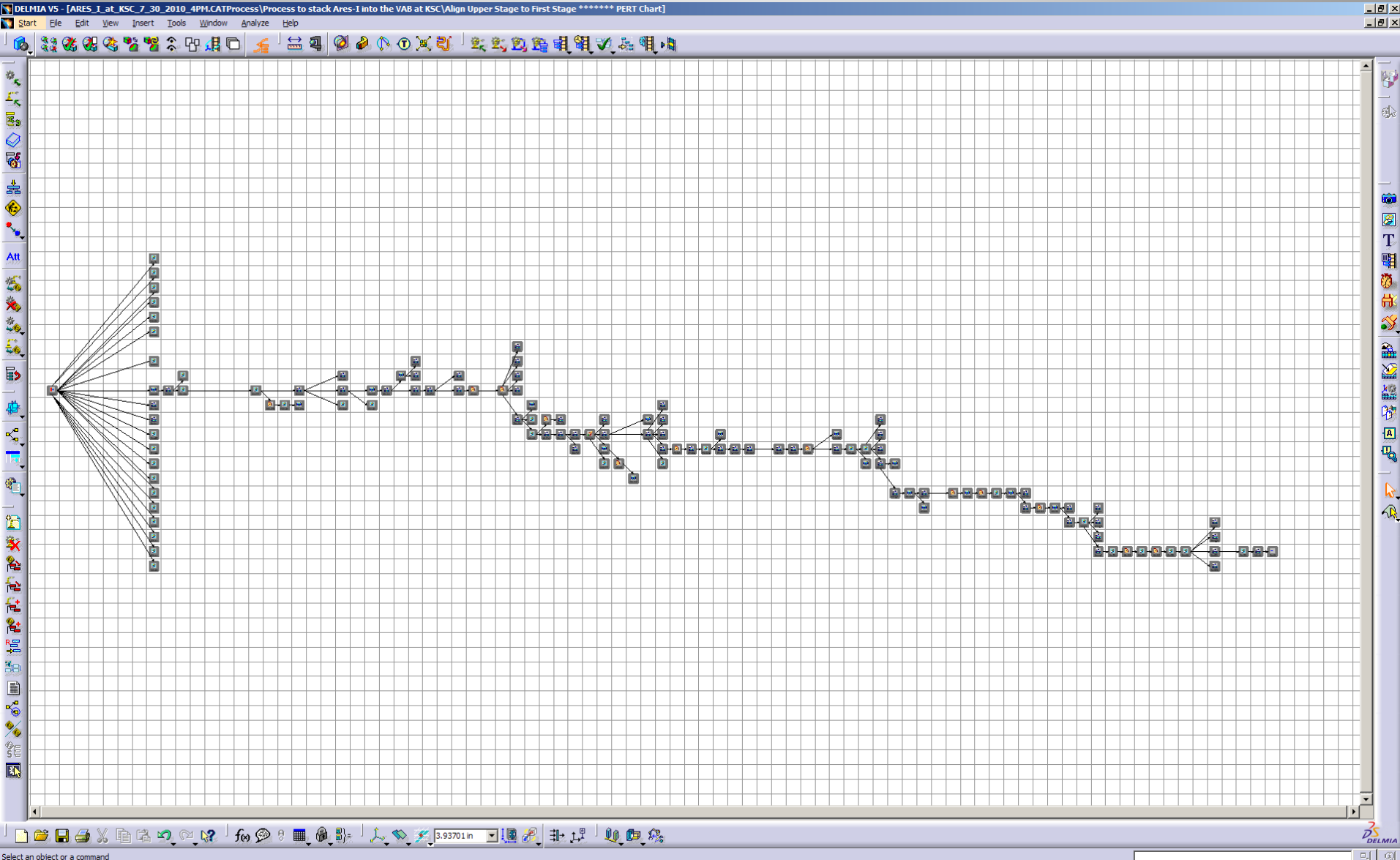
DELMIA



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UPPER STAGE MOVE SUBROUTINE



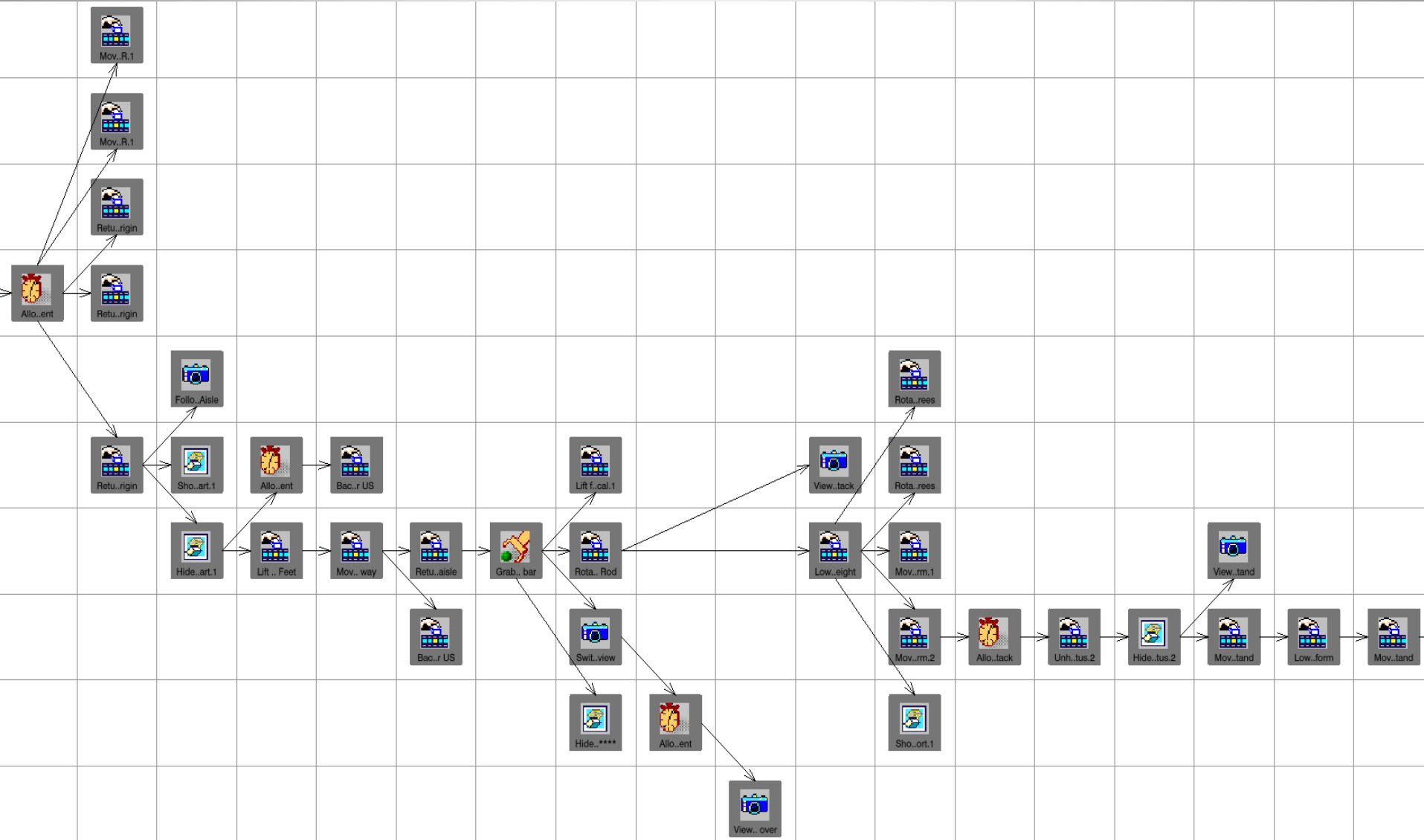


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UPPER STAGE MOVE



SUBROUTINE BREAKDOWN

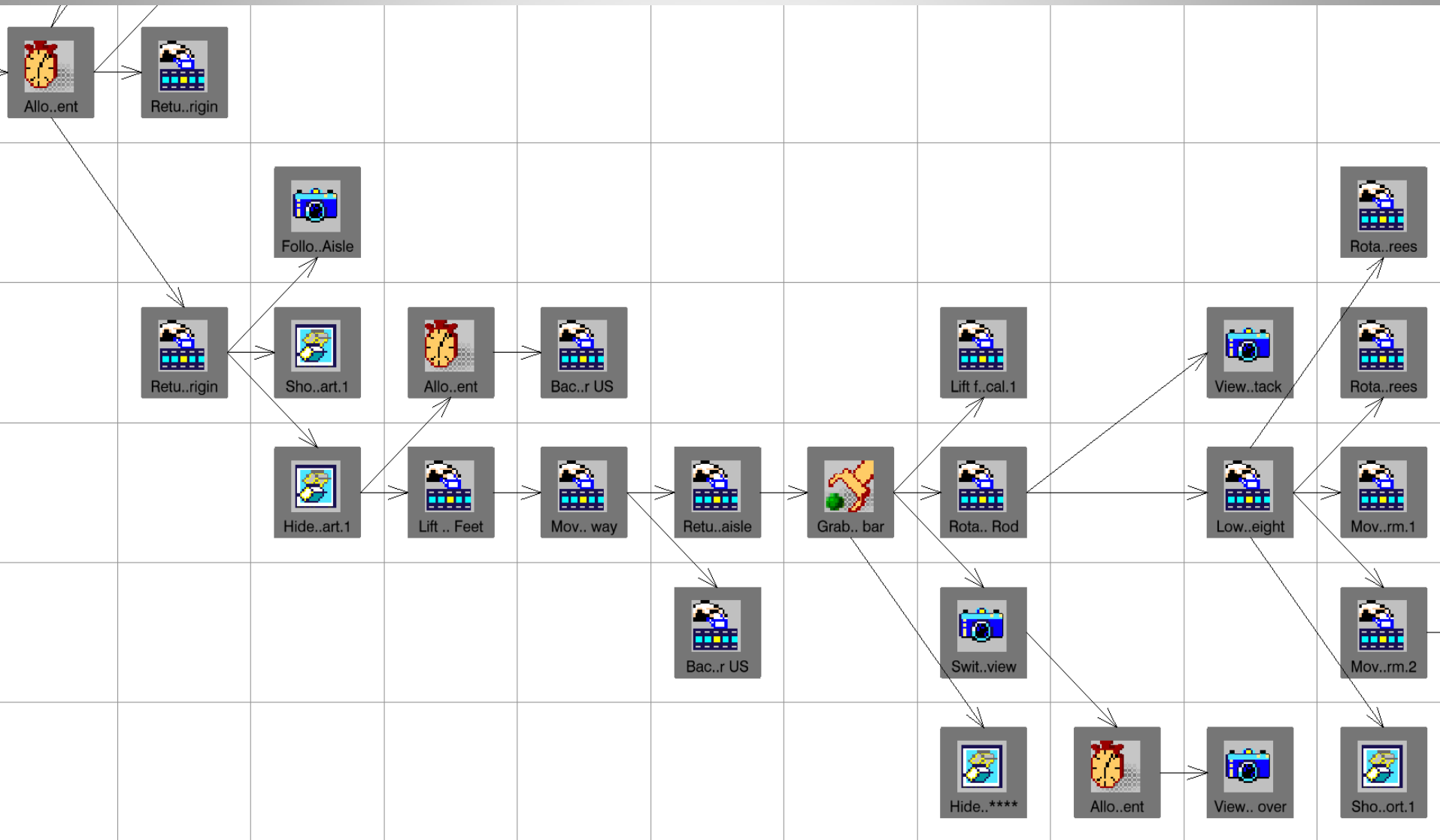




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SUBROUTINE BREAKDOWN

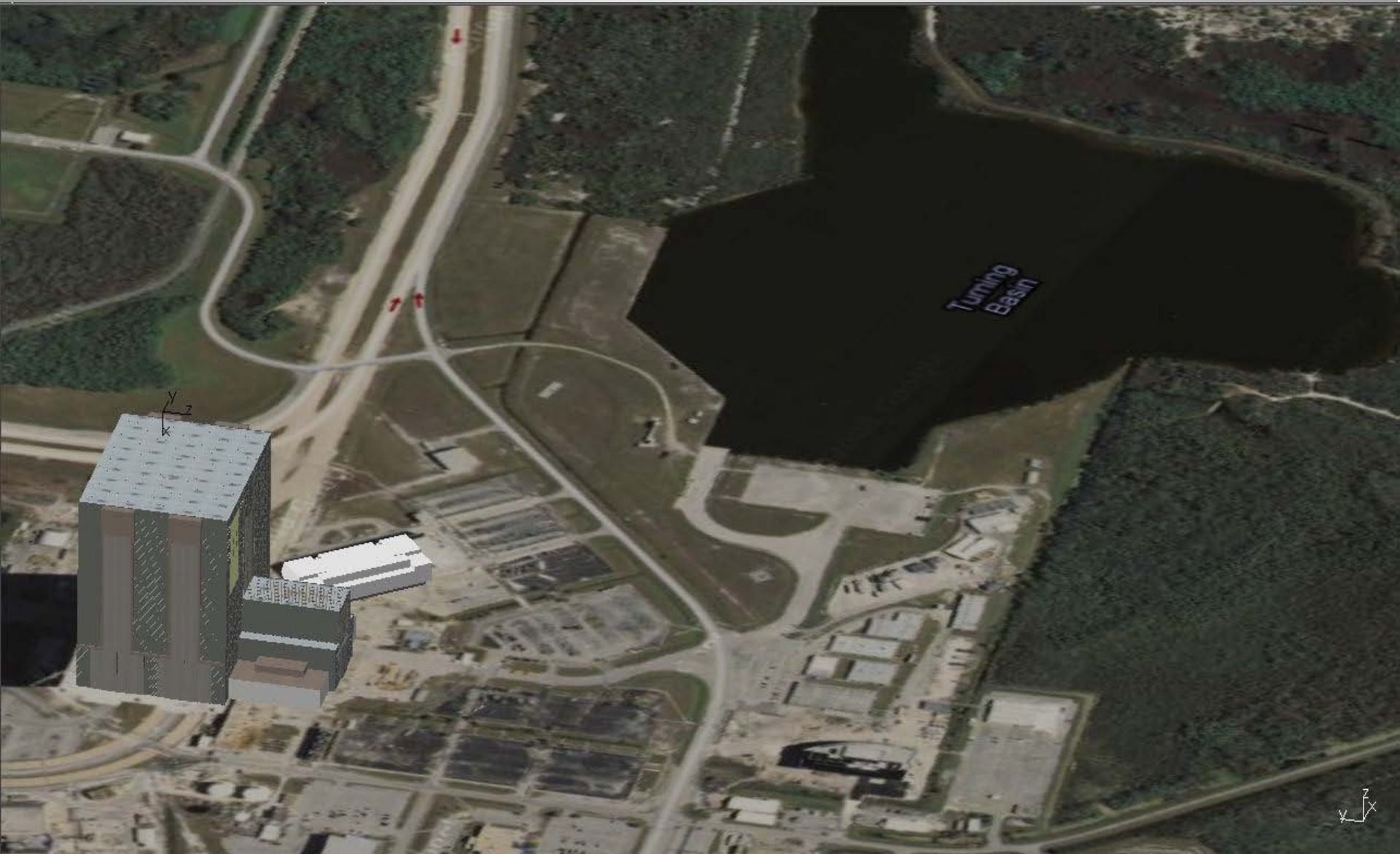




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OVERHEAD IMAGE OF THE VAB AND THE TURNING BASIN



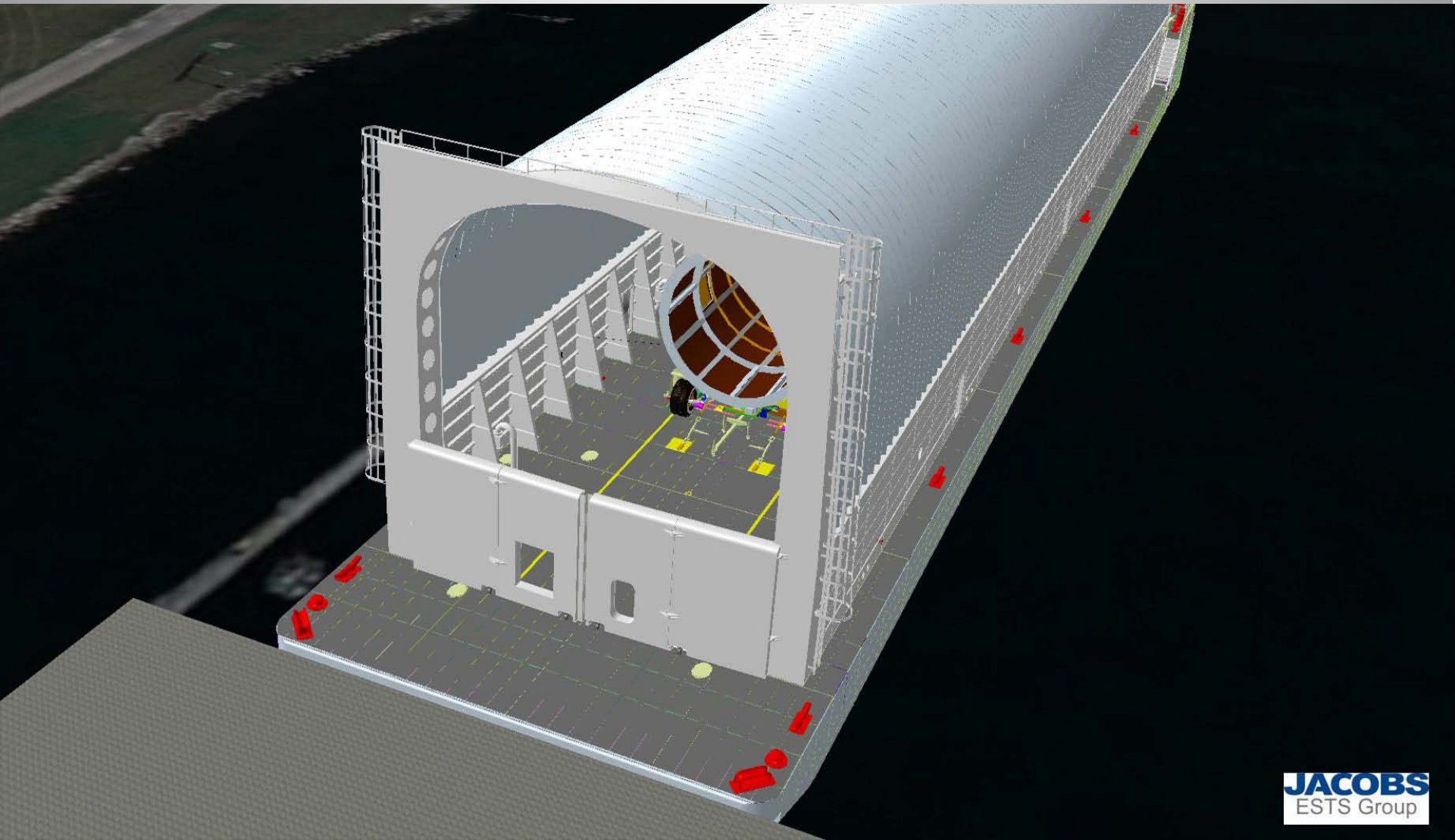


Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



PEGASUS BARGE AT THE TURNING BASIN

(IMAGE PROVIDED BY JACOBY BERRY)



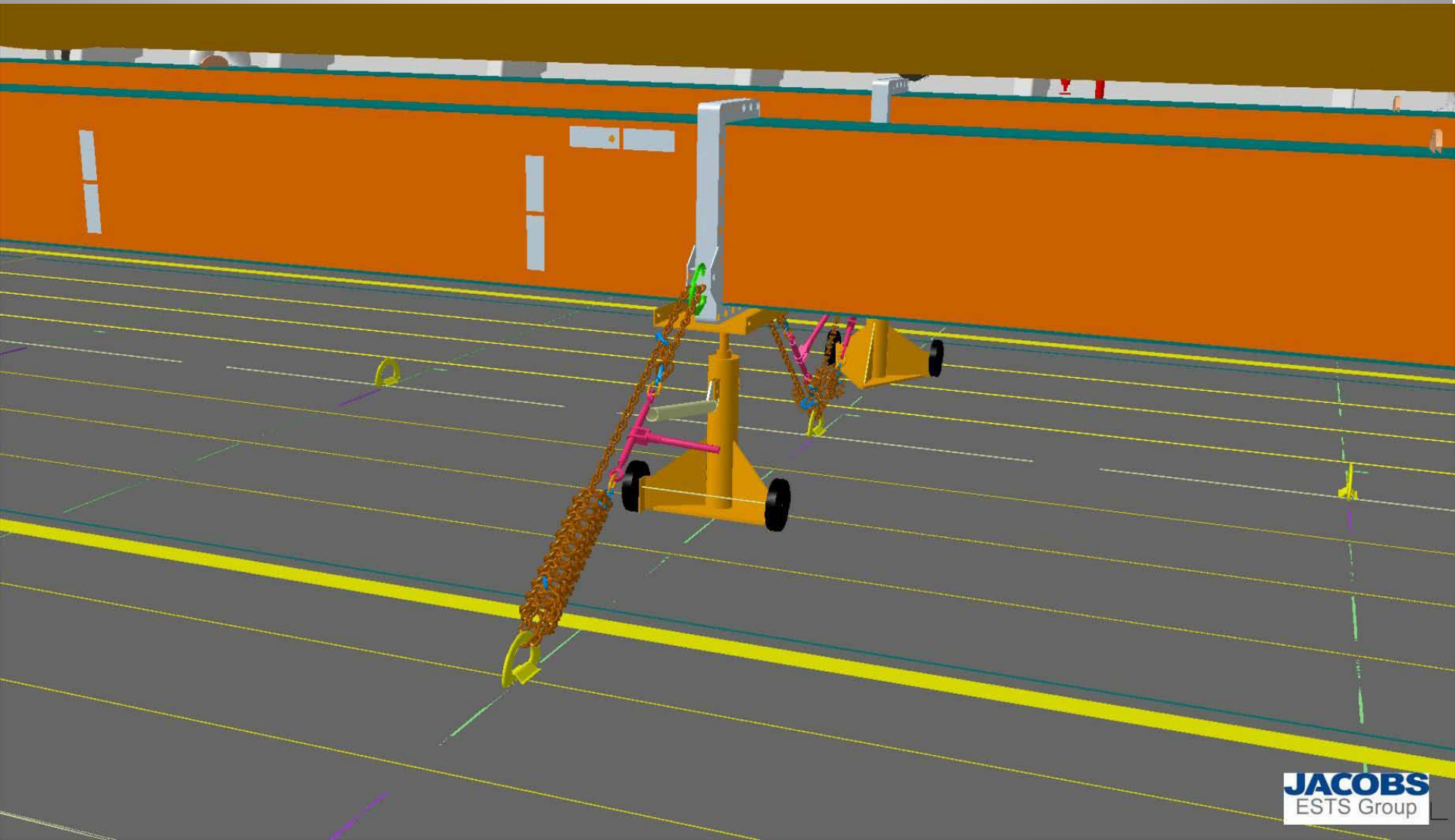


Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



REMOVING MID-SECTION SPRING TENSIONERS

(IMAGE PROVIDED BY JACOBY BERRY)



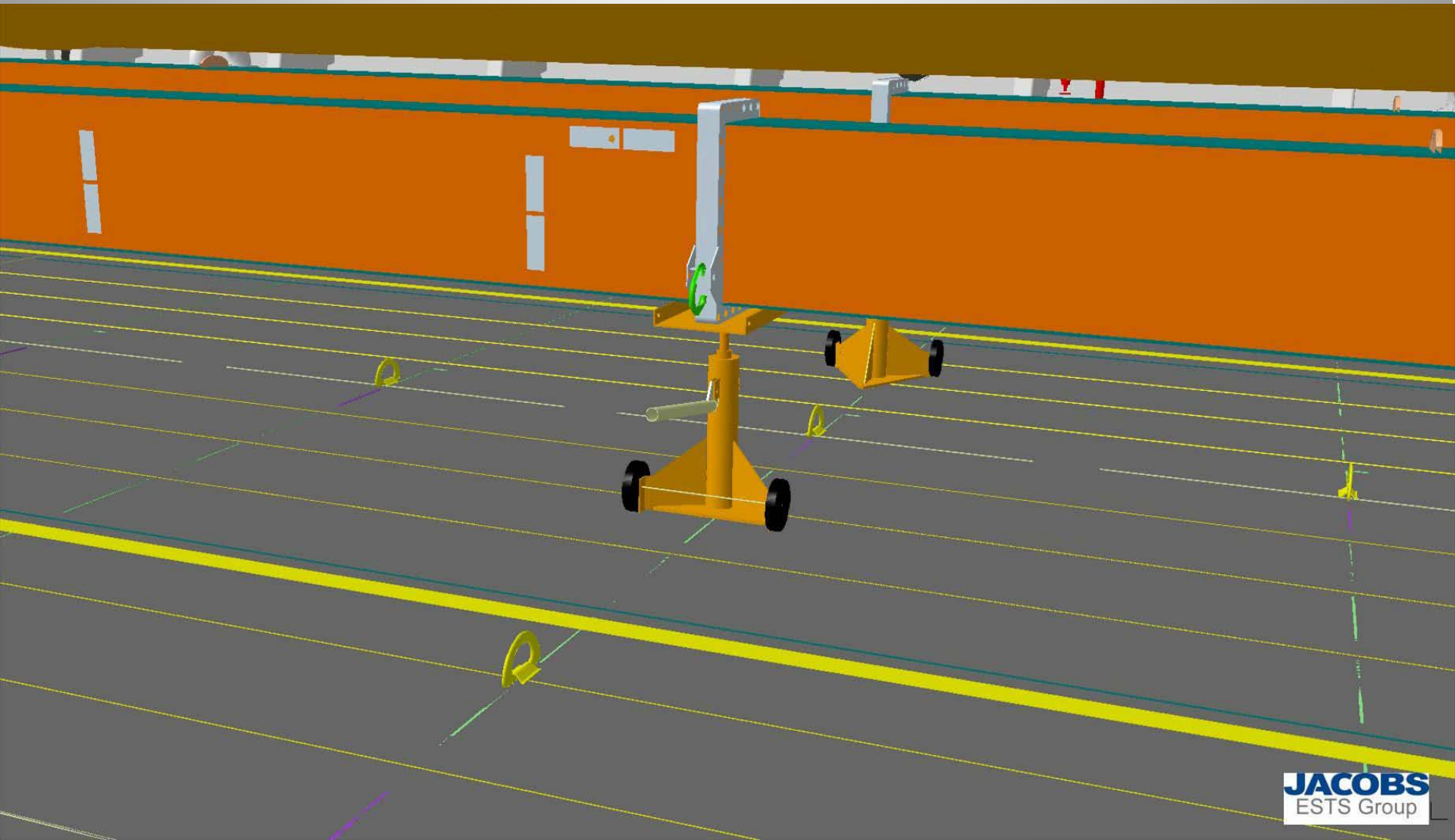


Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



REMOVING MID-SECTION SPRING TENSIONERS

(IMAGE PROVIDED BY JACOBY BERRY)



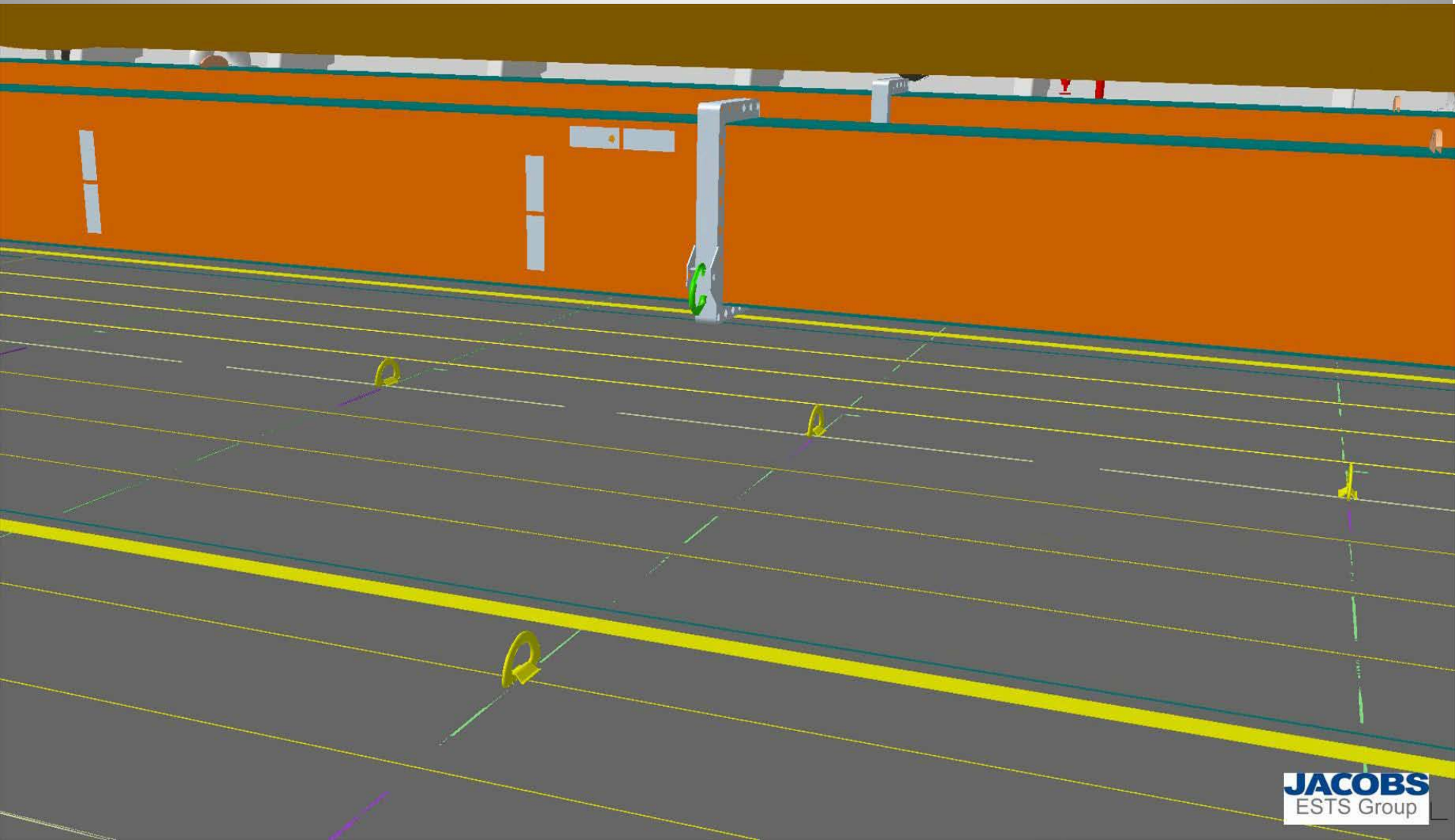


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SPRING TENSIONERS REMOVED

(IMAGE PROVIDED BY JACOBY BERRY)



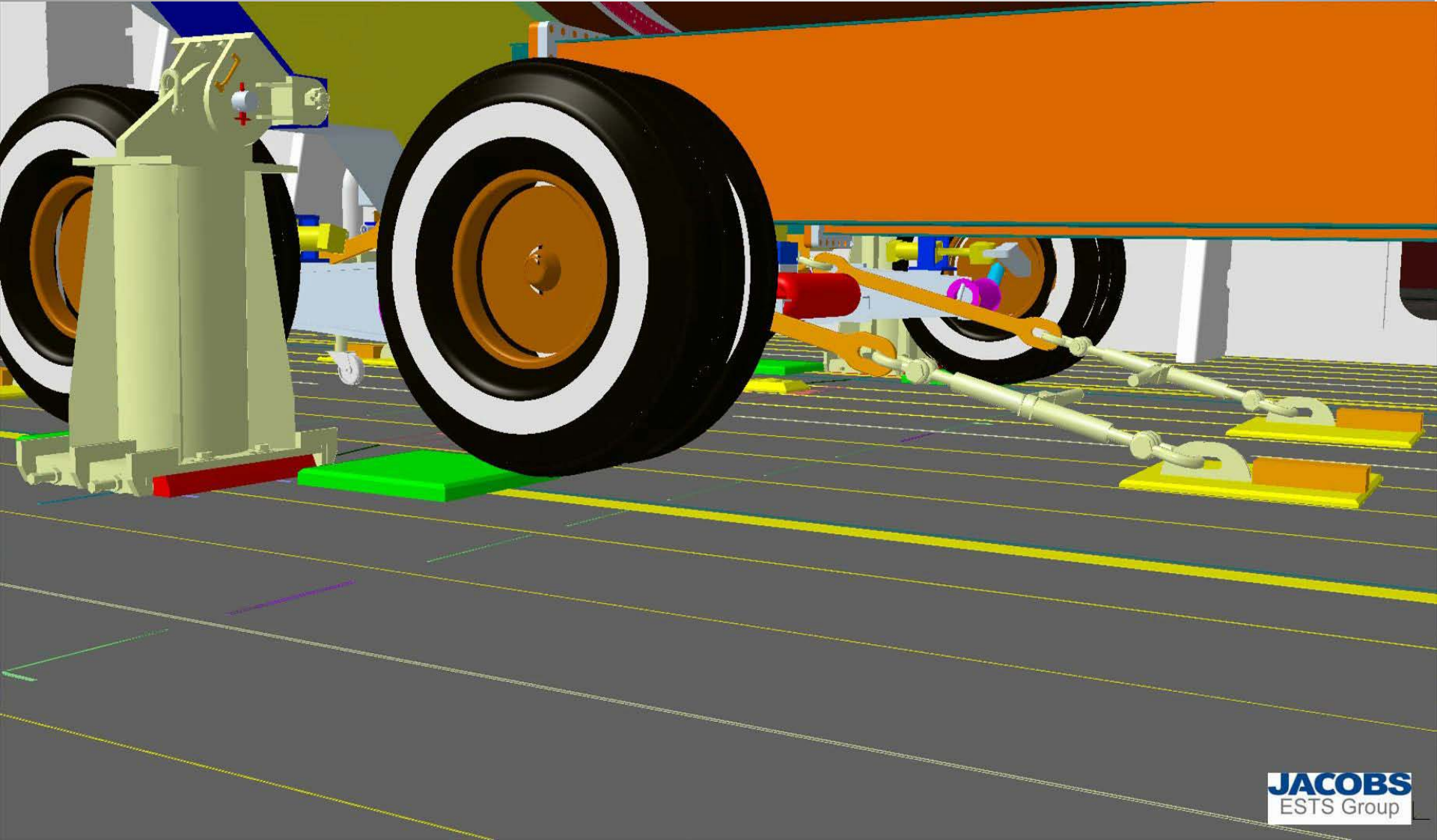


Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



AFT REAR TENSIONERS TIE DOWNS

(IMAGE PROVIDED BY JACOBY BERRY)



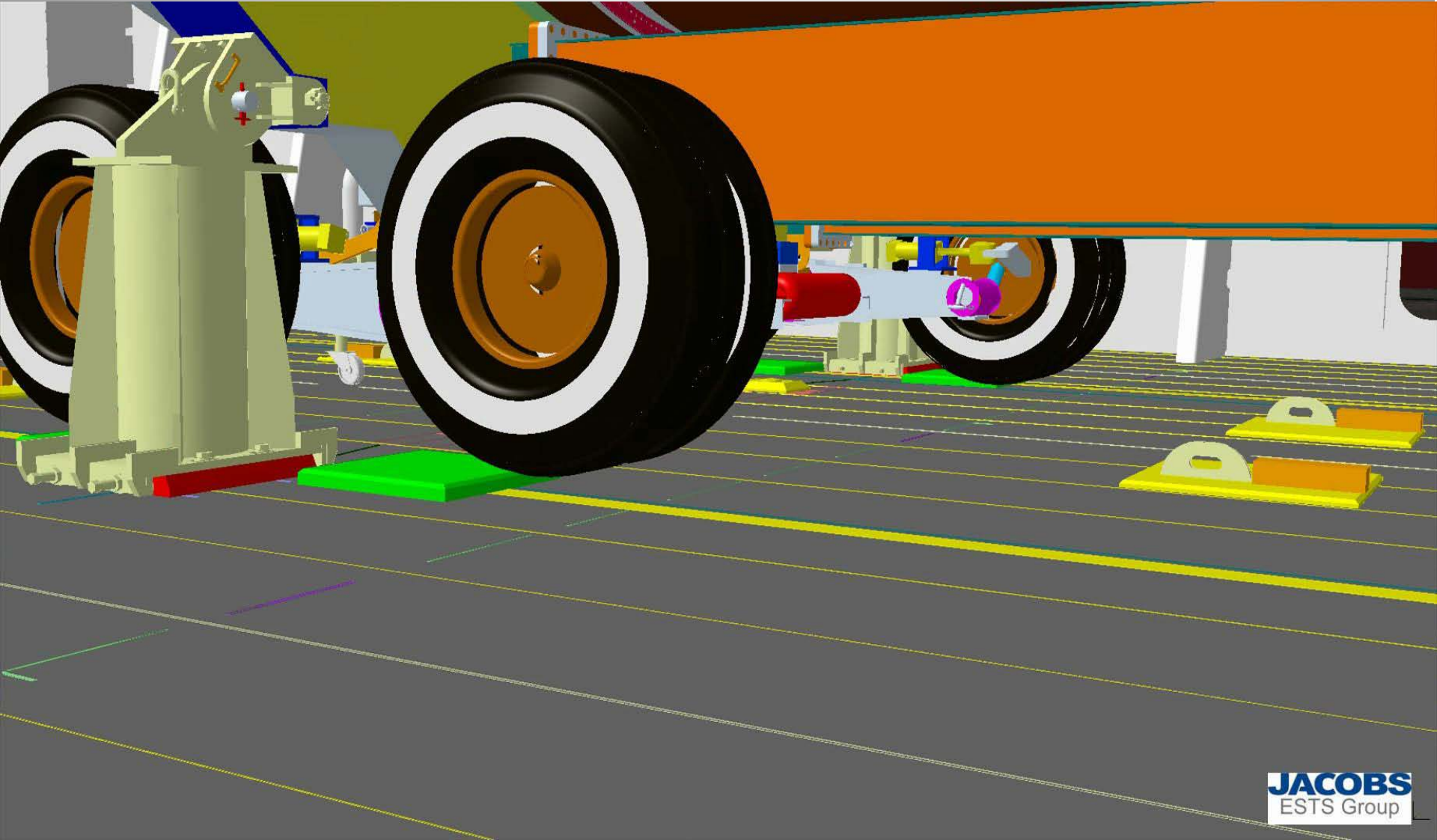


Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



AFT REAR TENSIONERS TIE DOWNS REMOVED

(IMAGE PROVIDED BY JACOBY BERRY)



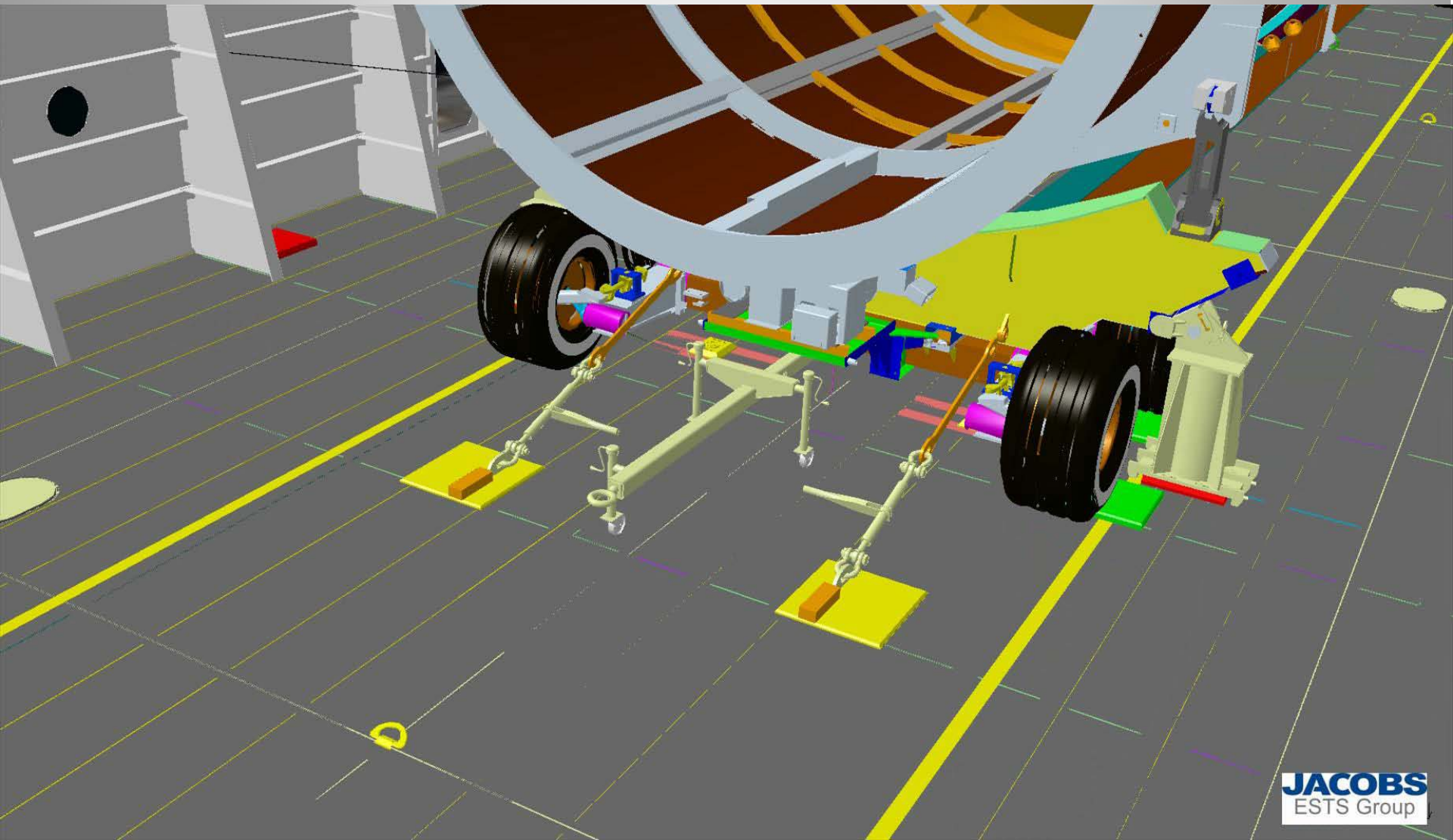


Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



AFT FORWARD TENSIONERS TIE DOWNS

(IMAGE PROVIDED BY JACOBY BERRY)



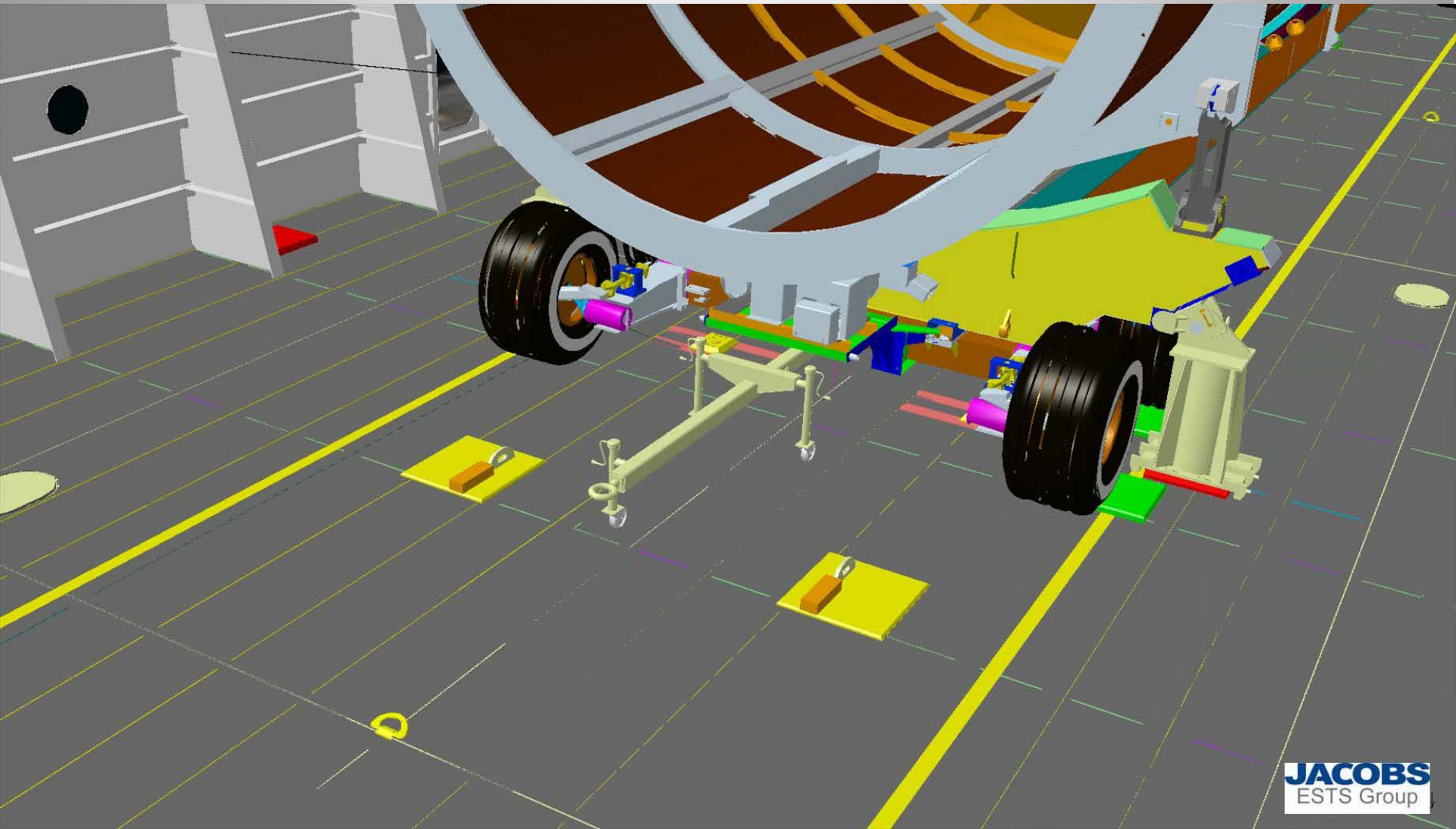


Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



AFT FORWARD TENSIONERS TIE DOWNS REMOVED

(IMAGE PROVIDED BY JACOBY BERRY)

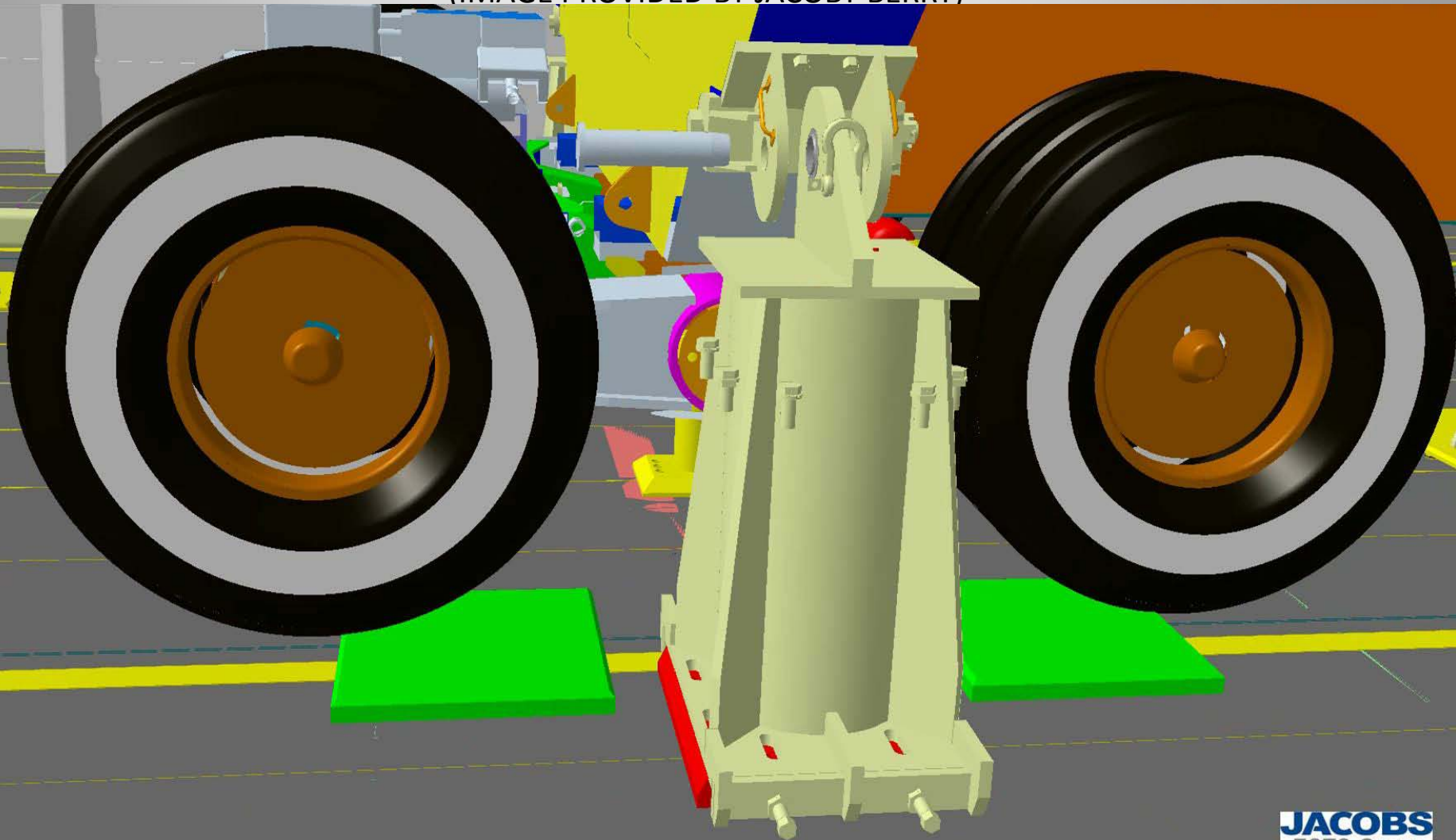




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REMOVING THE AFT HOLDDOWN POST (IMAGE PROVIDED BY JACOBY BERRY)



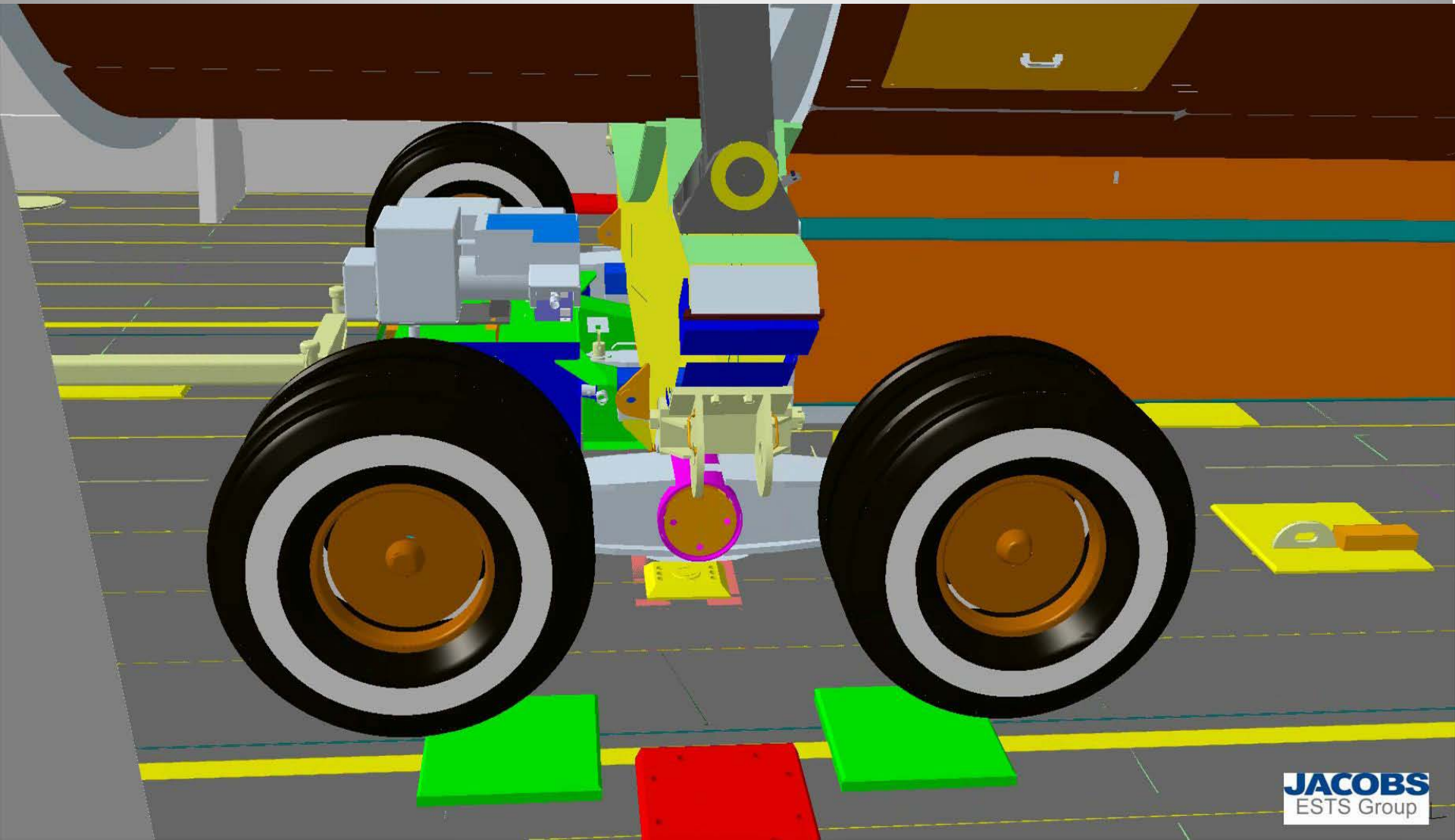


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HOLDDOWN POST AND MOUNT REMOVED

(IMAGE PROVIDED BY JACOBY BERRY)

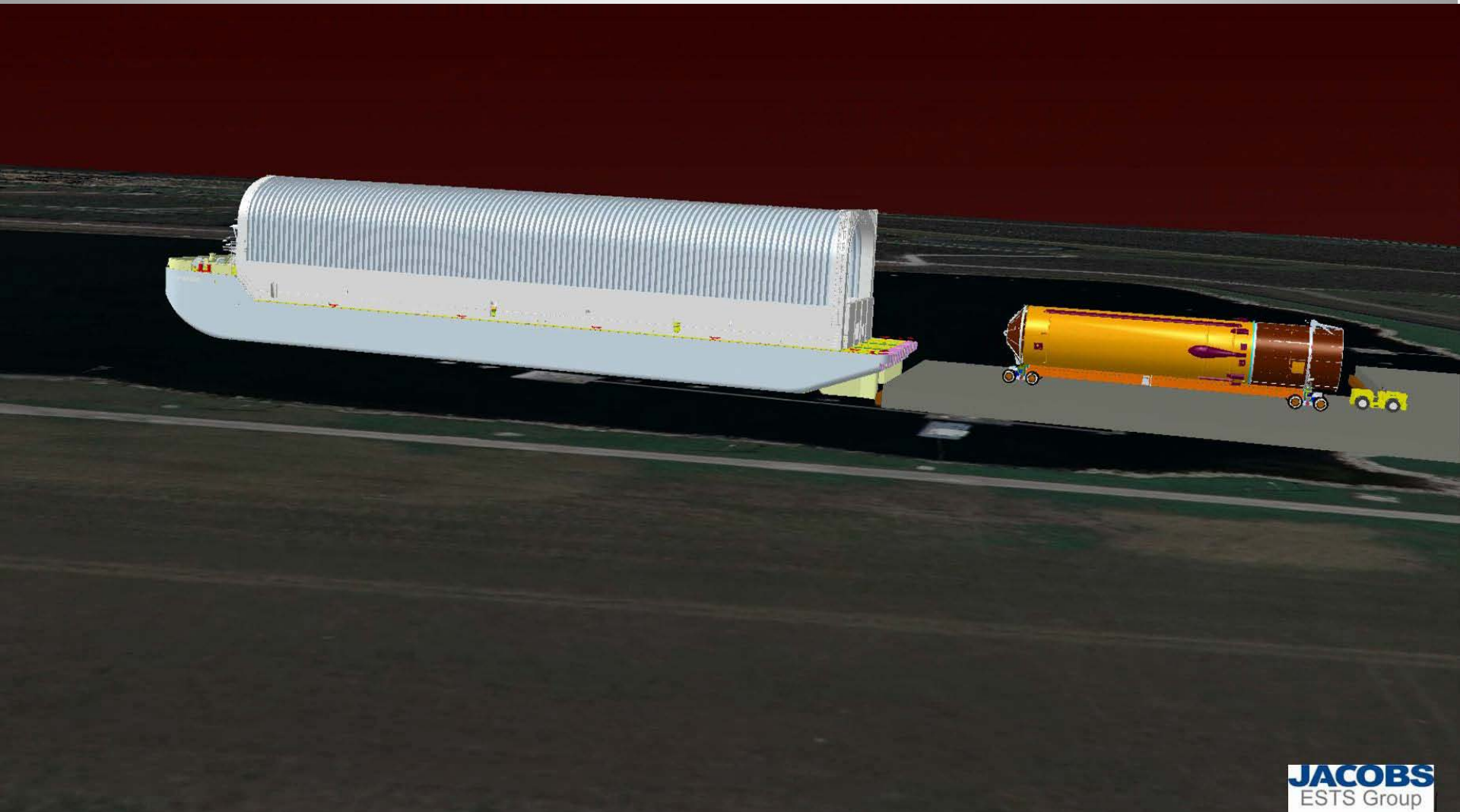




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US LEAVING THE PEGASUS BARGE (IMAGE PROVIDED BY JACOBY BERRY)

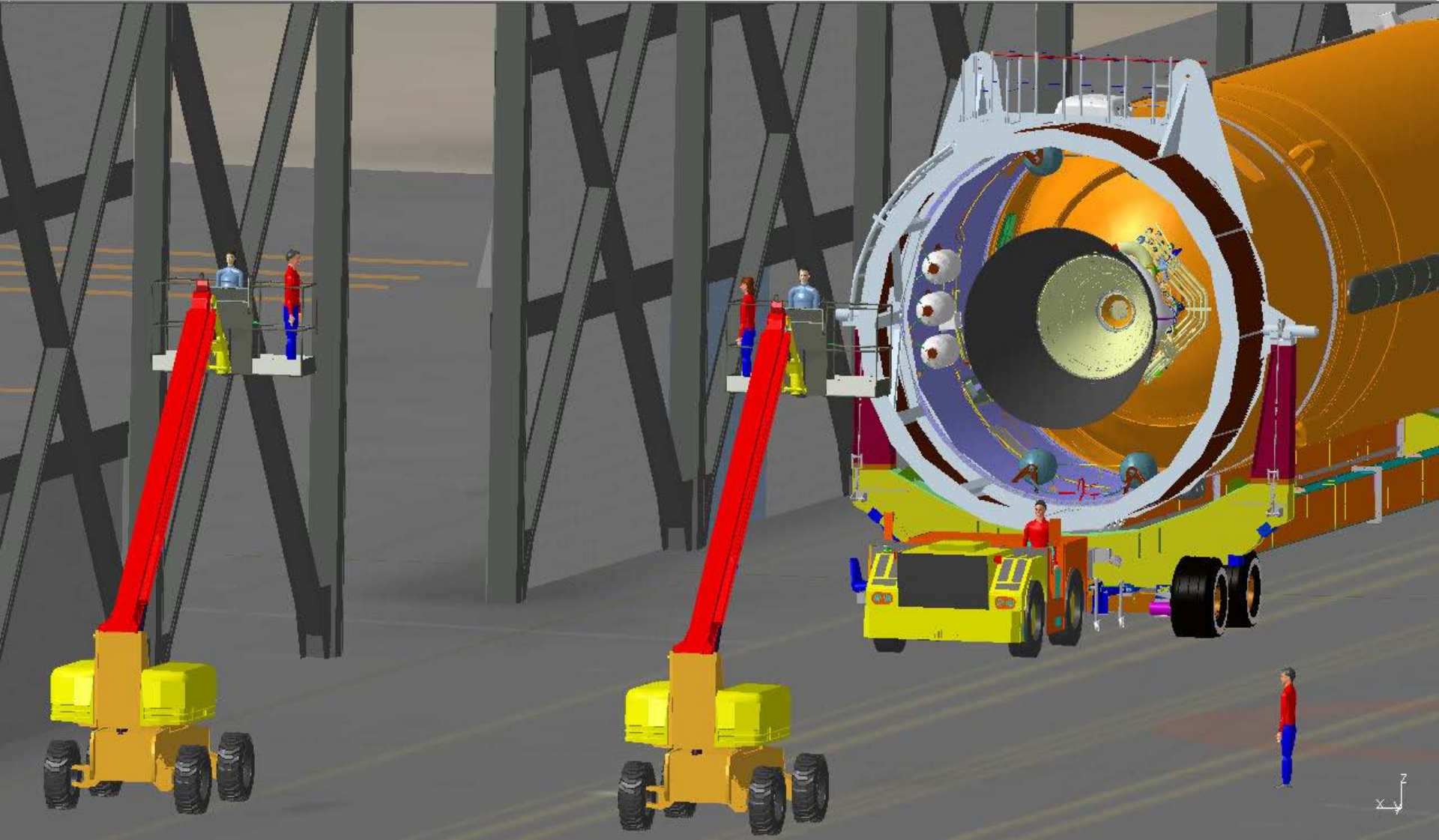




Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



UPPER STAGE ARRIVING AT TRANSFER AISLE

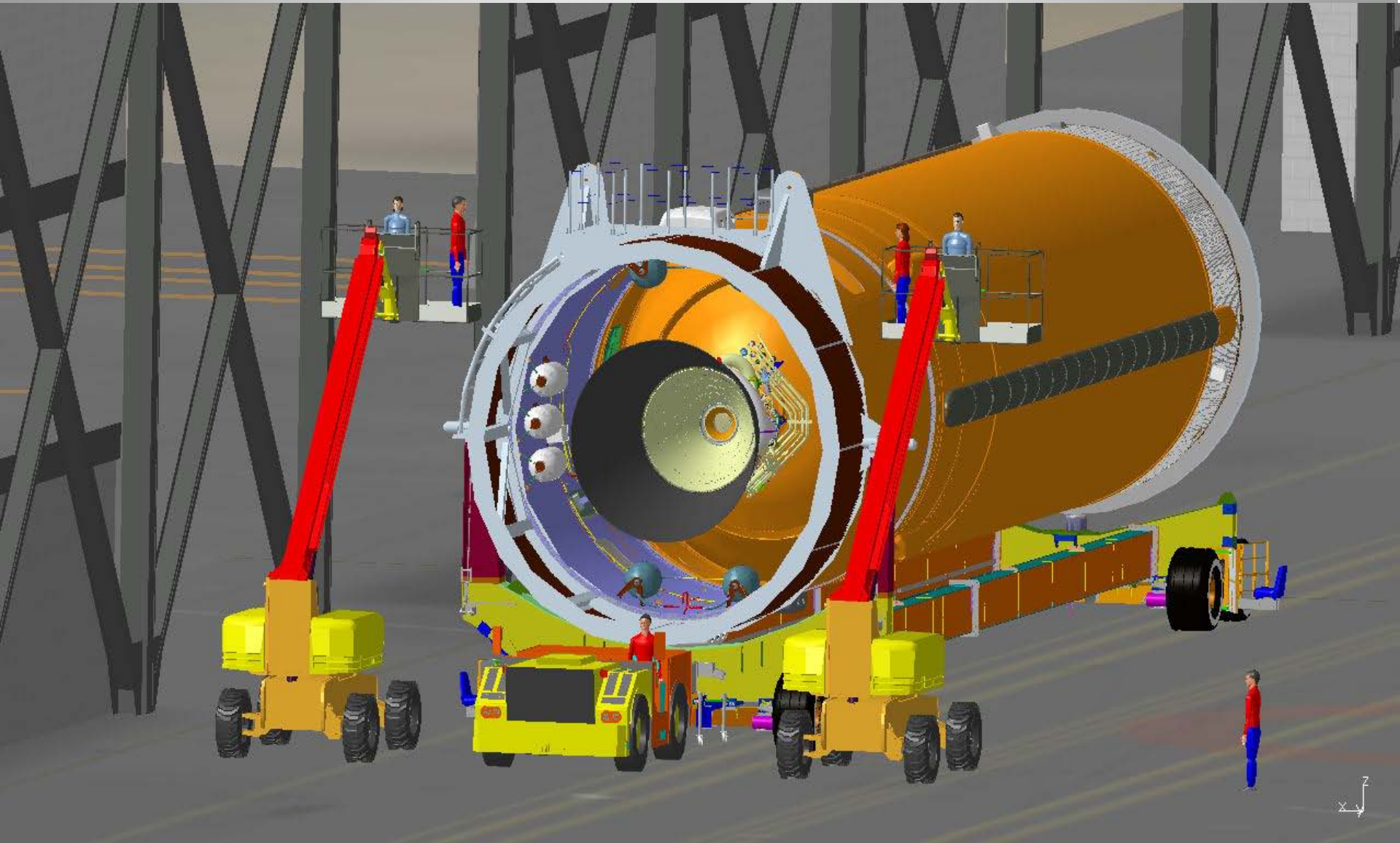




Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



UPPER STAGE RECEIVING/INSPECTION IN TRANSFER AISLE

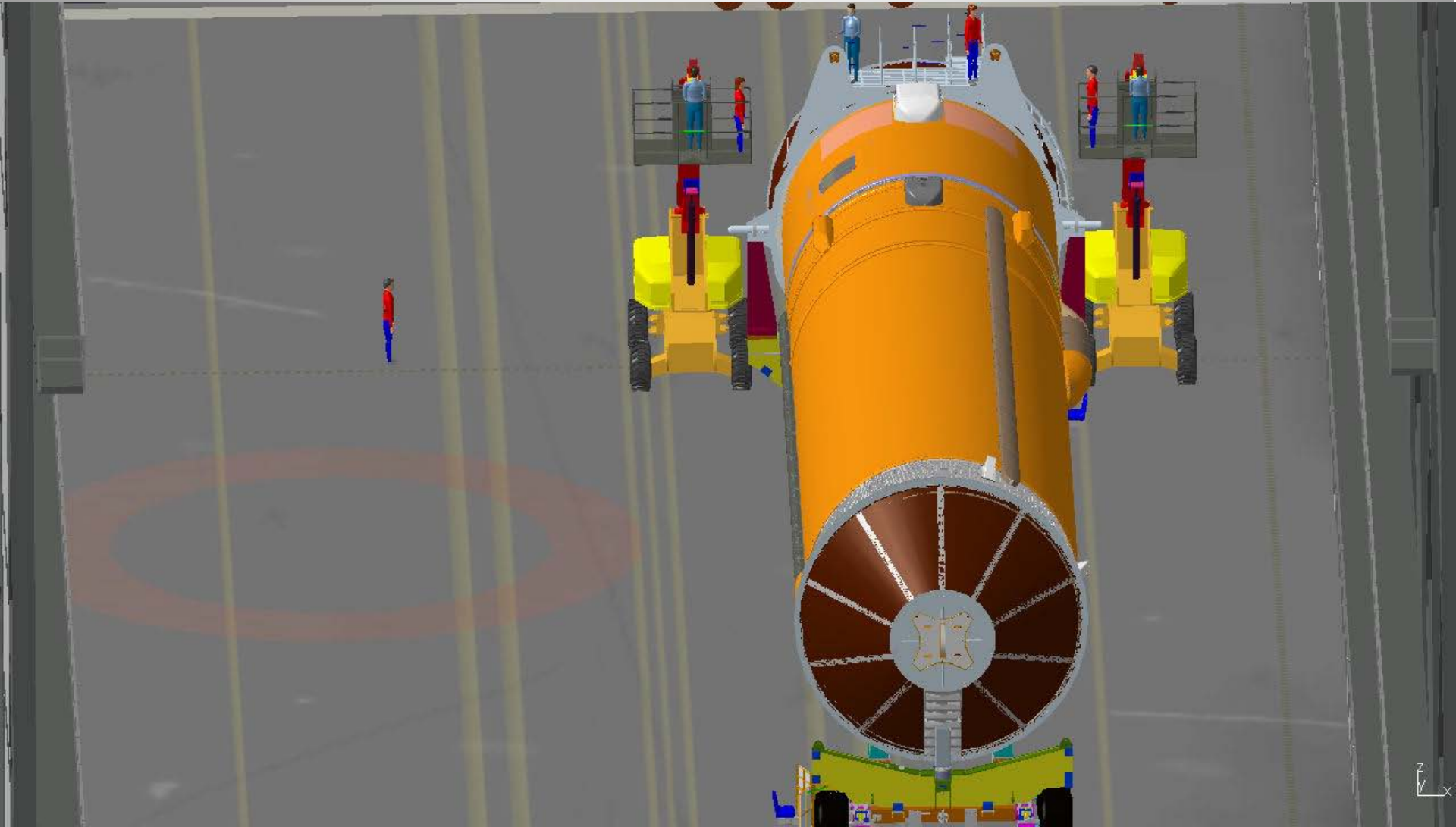




Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



OVERHEAD VIEW OF UPPER STAGE RECEIVING/INSPECTION IN TRANSFER AISLE



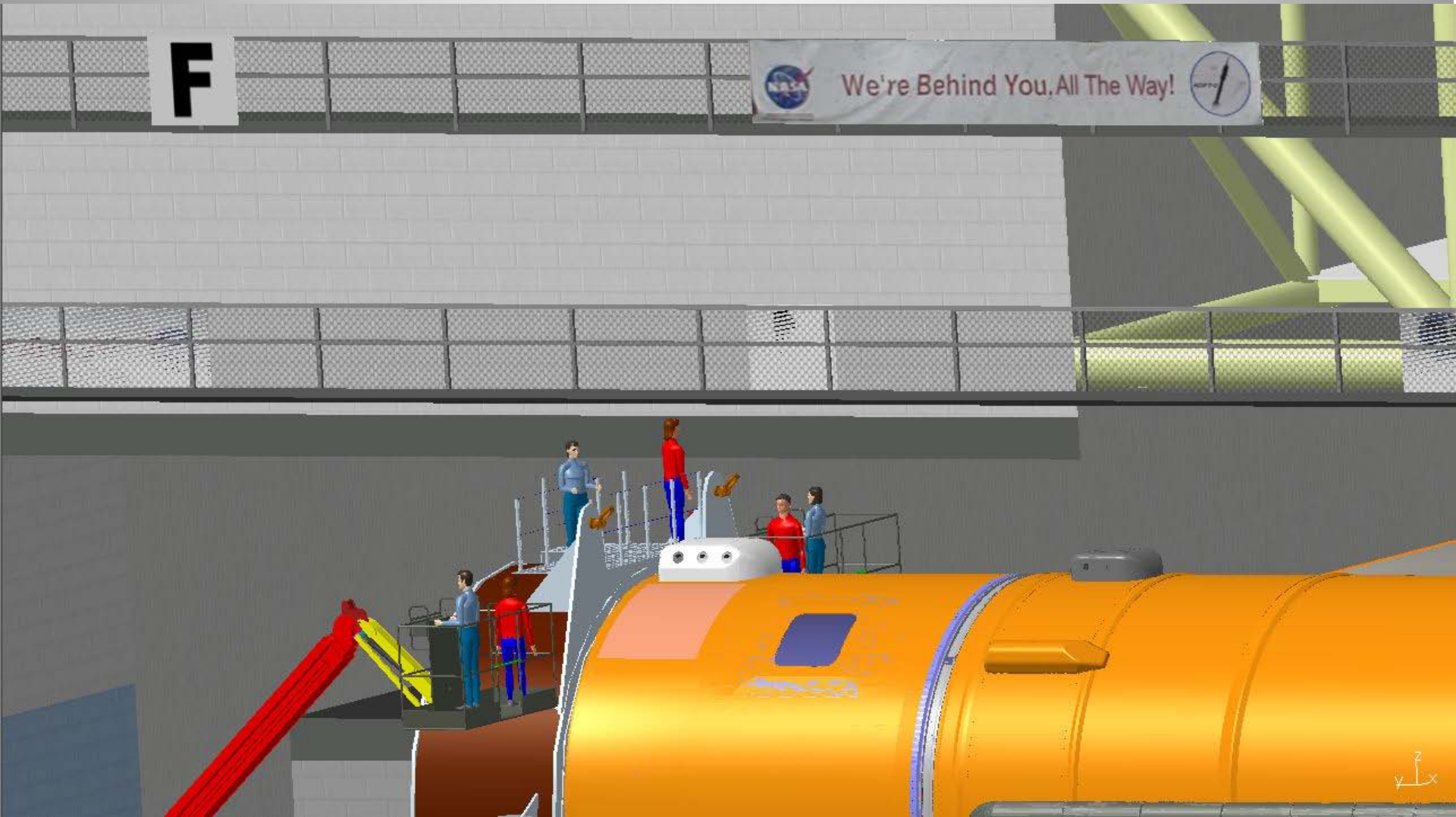


Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



CONNECT CABLING TO UPPER STAGE AFT LIFTING HARDWARE

View 1



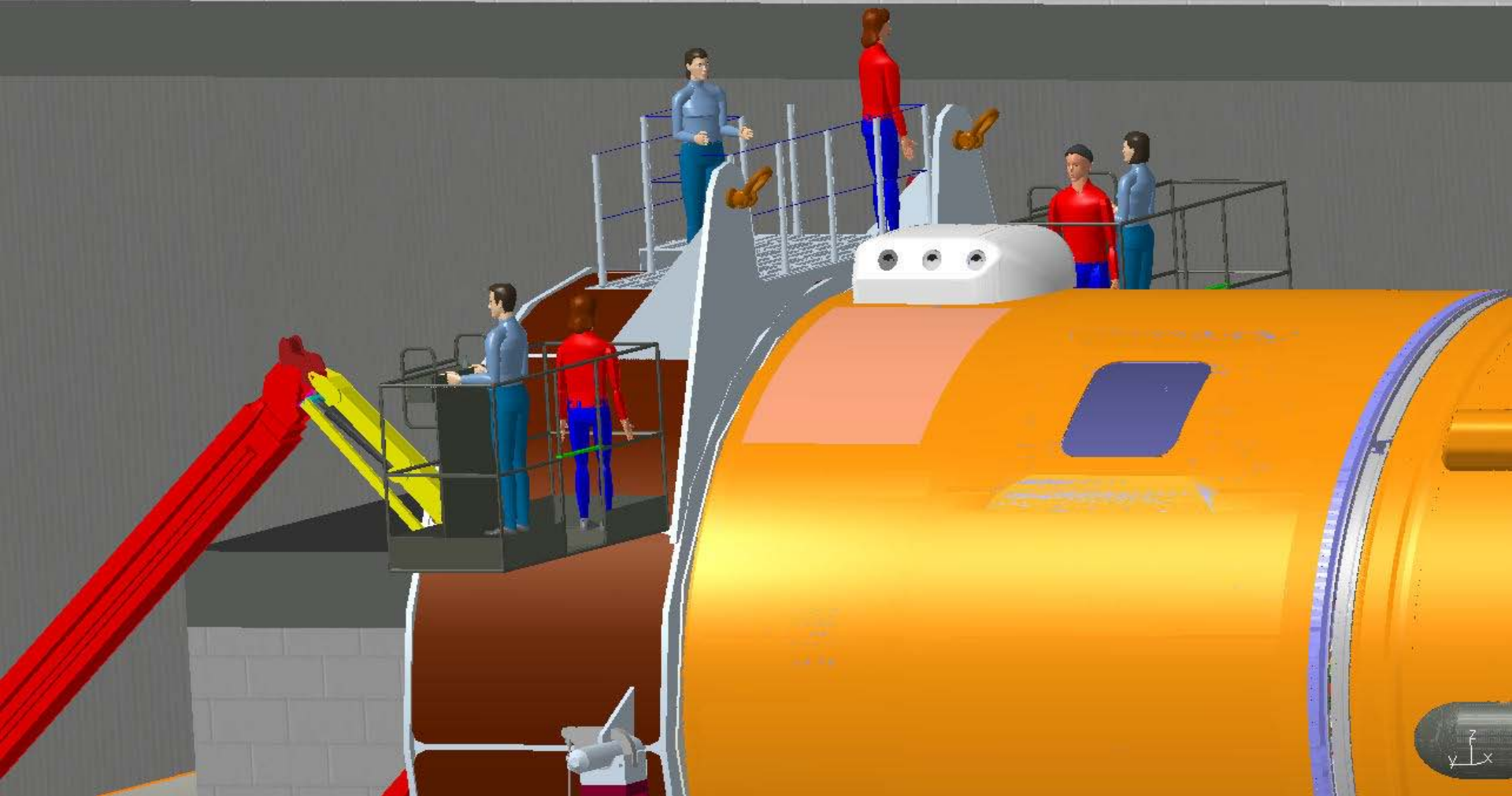


Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



CONNECT CABLING TO UPPER STAGE AFT LIFTING HARDWARE

View2



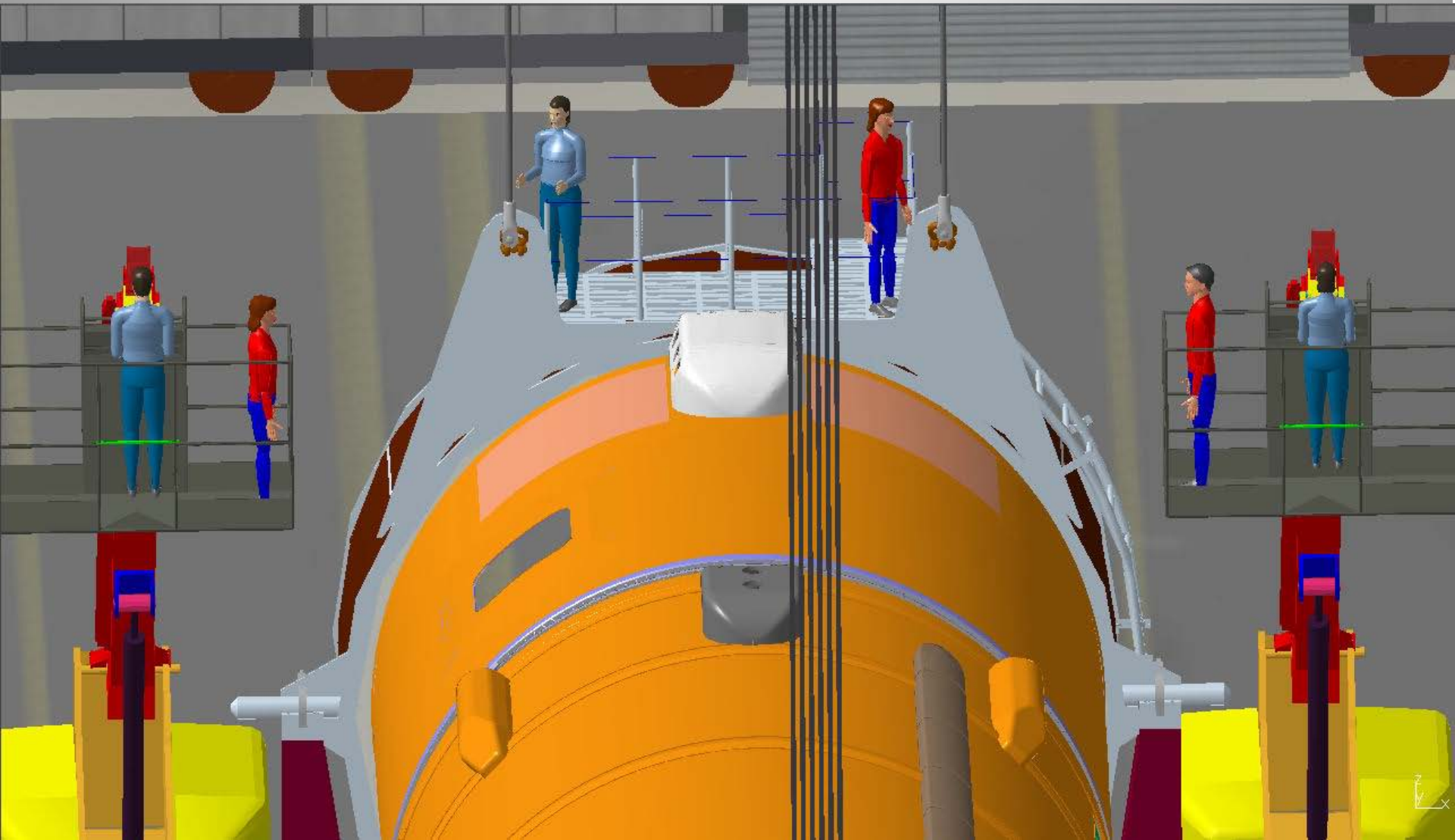


Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC

CONNECT CABLING TO UPPER STAGE AFT LIFTING HARDWARE



View 3



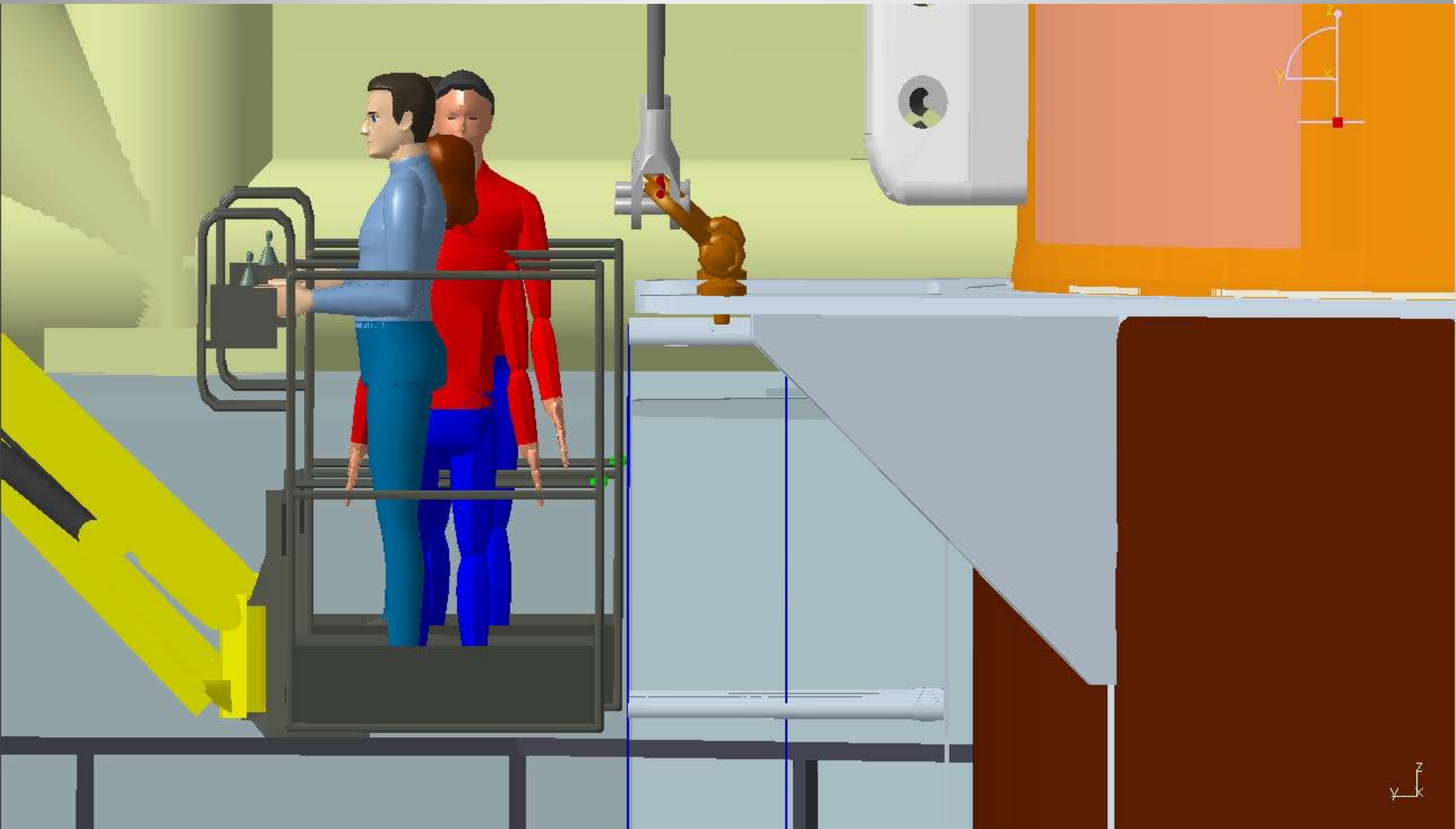


Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



CONNECT CABLING TO UPPER STAGE AFT LIFTING HARDWARE

View 4



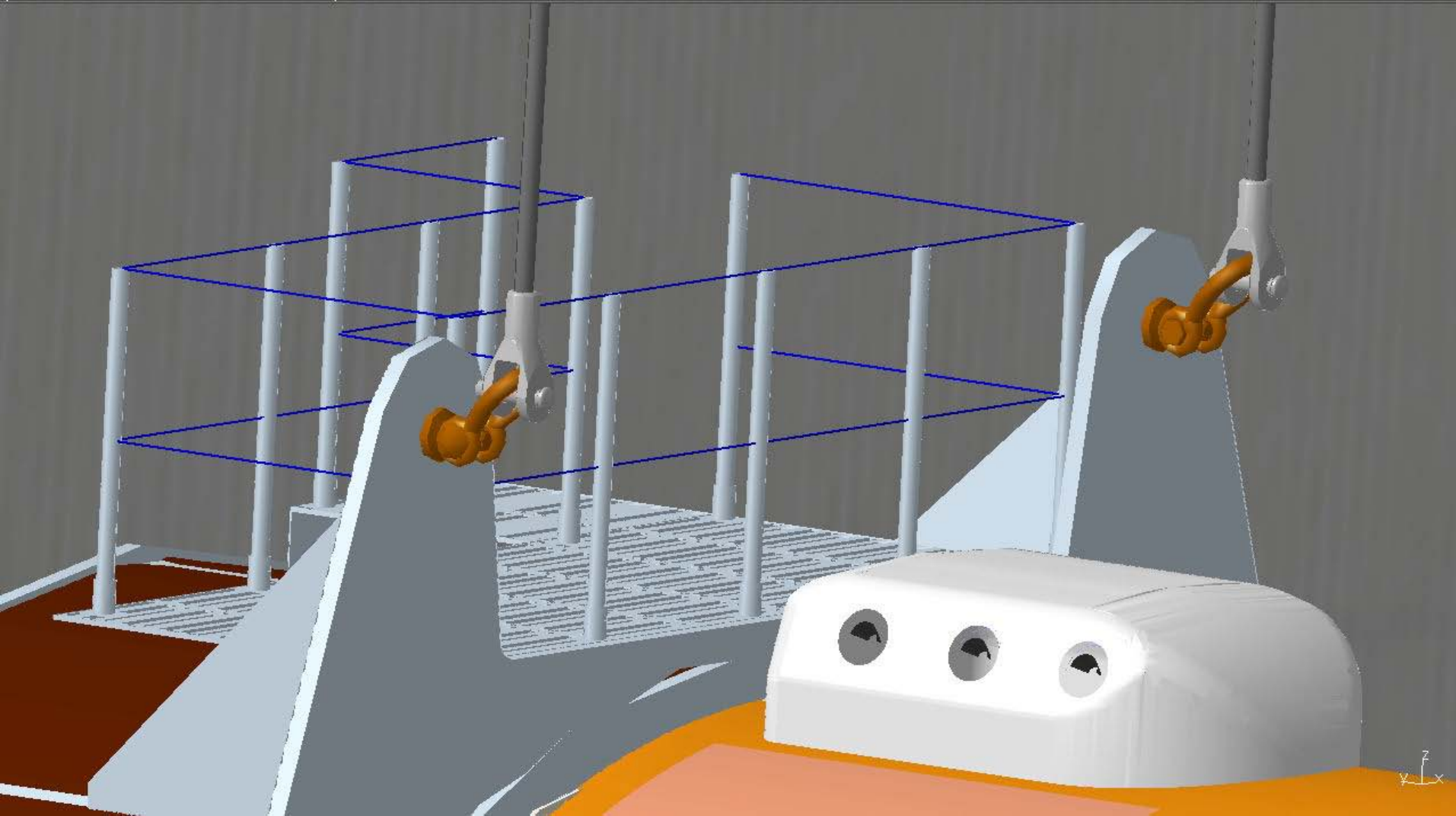


Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



CONNECT CABLING TO UPPER STAGE AFT LIFTING HARDWARE

View 5

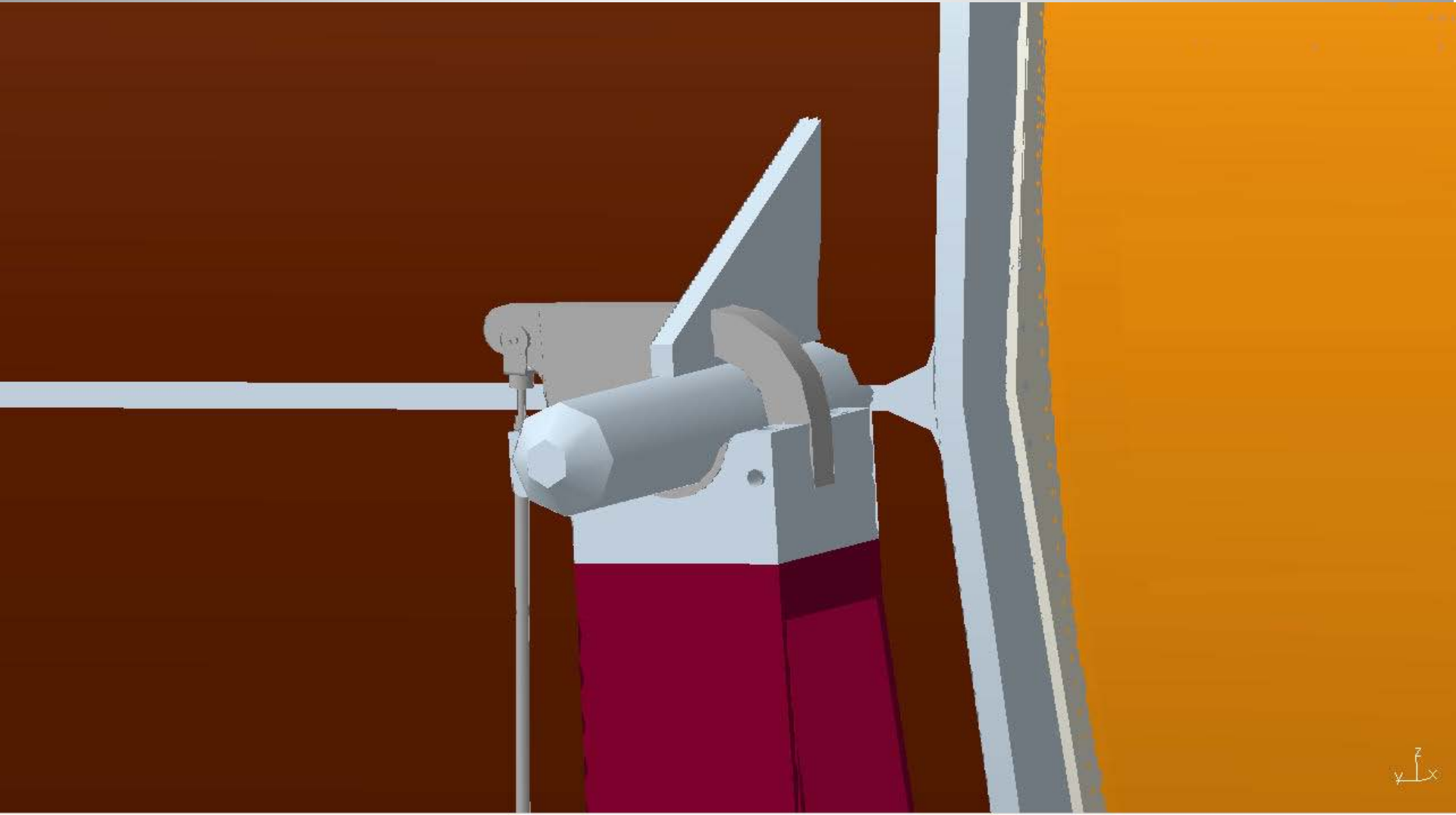




Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



CONNECT CABLING TO UPPER STAGE AFT LIFTING HARDWARE

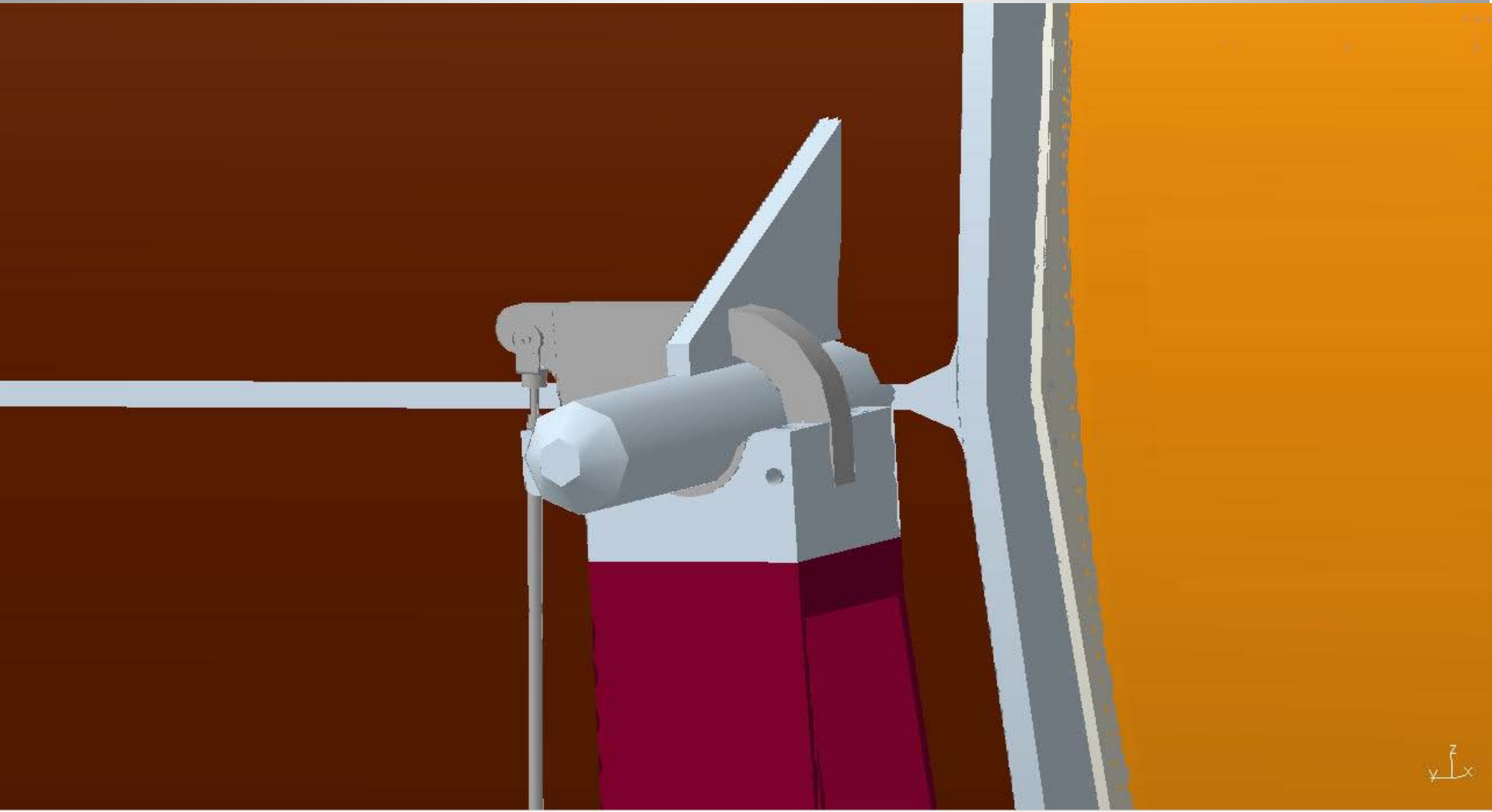




Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



UPPER STAGE TRANSPORTER AFT CONNECTOR



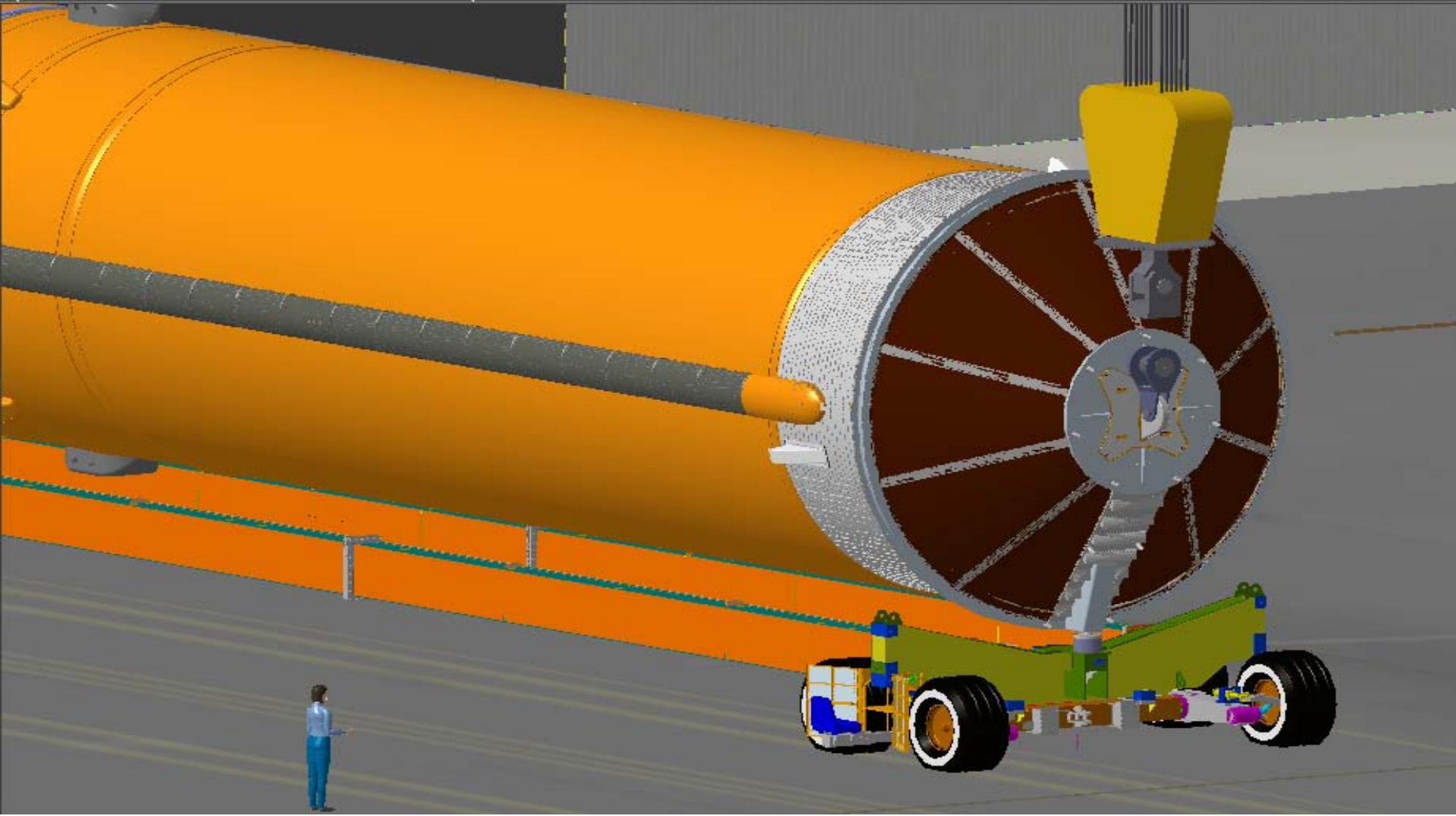
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Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



UPPER STAGE TRANSPORTER FORWARD CONNECTOR



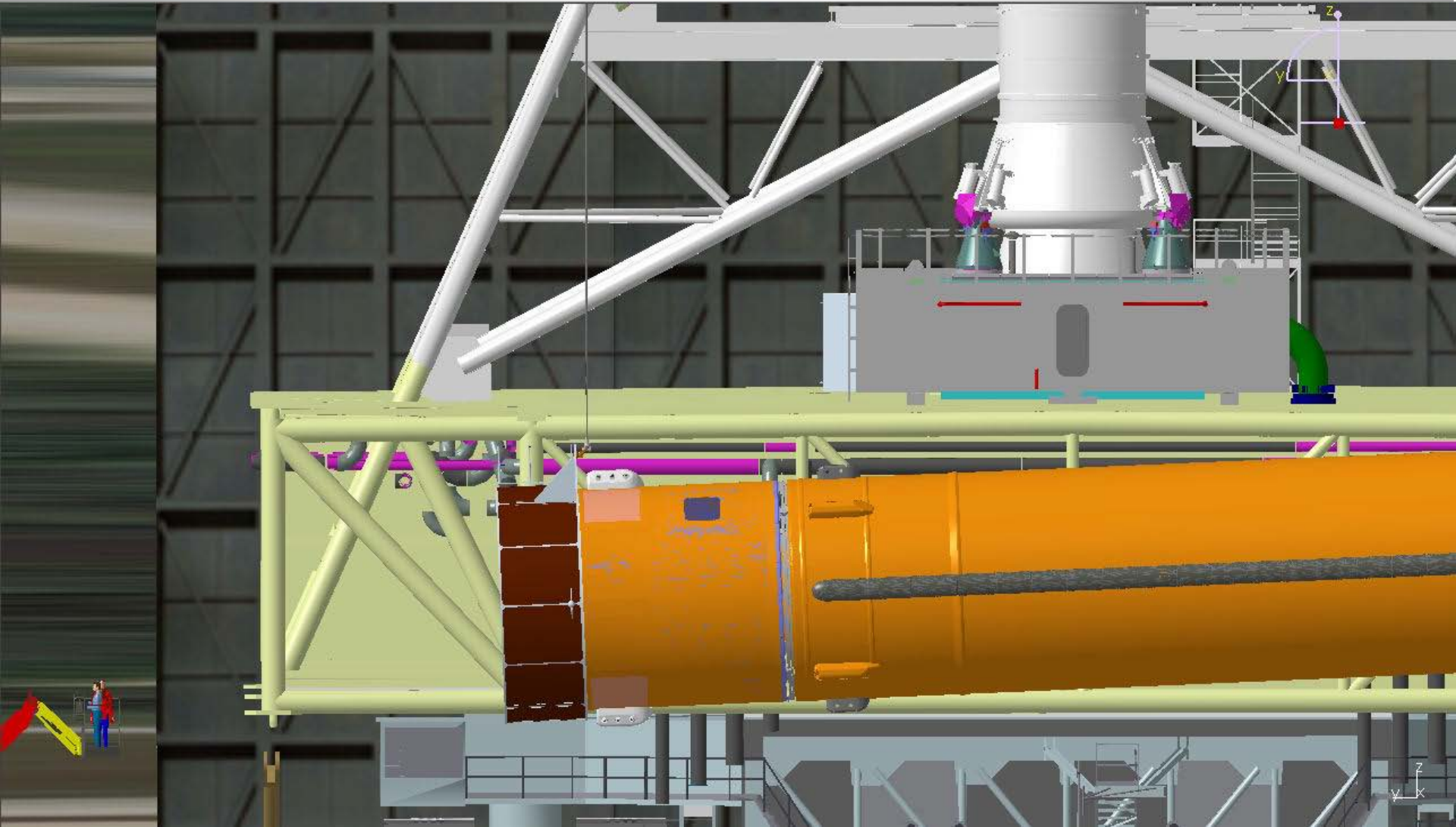


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ROTATE HORIZONTAL TO VERTICAL

View 1



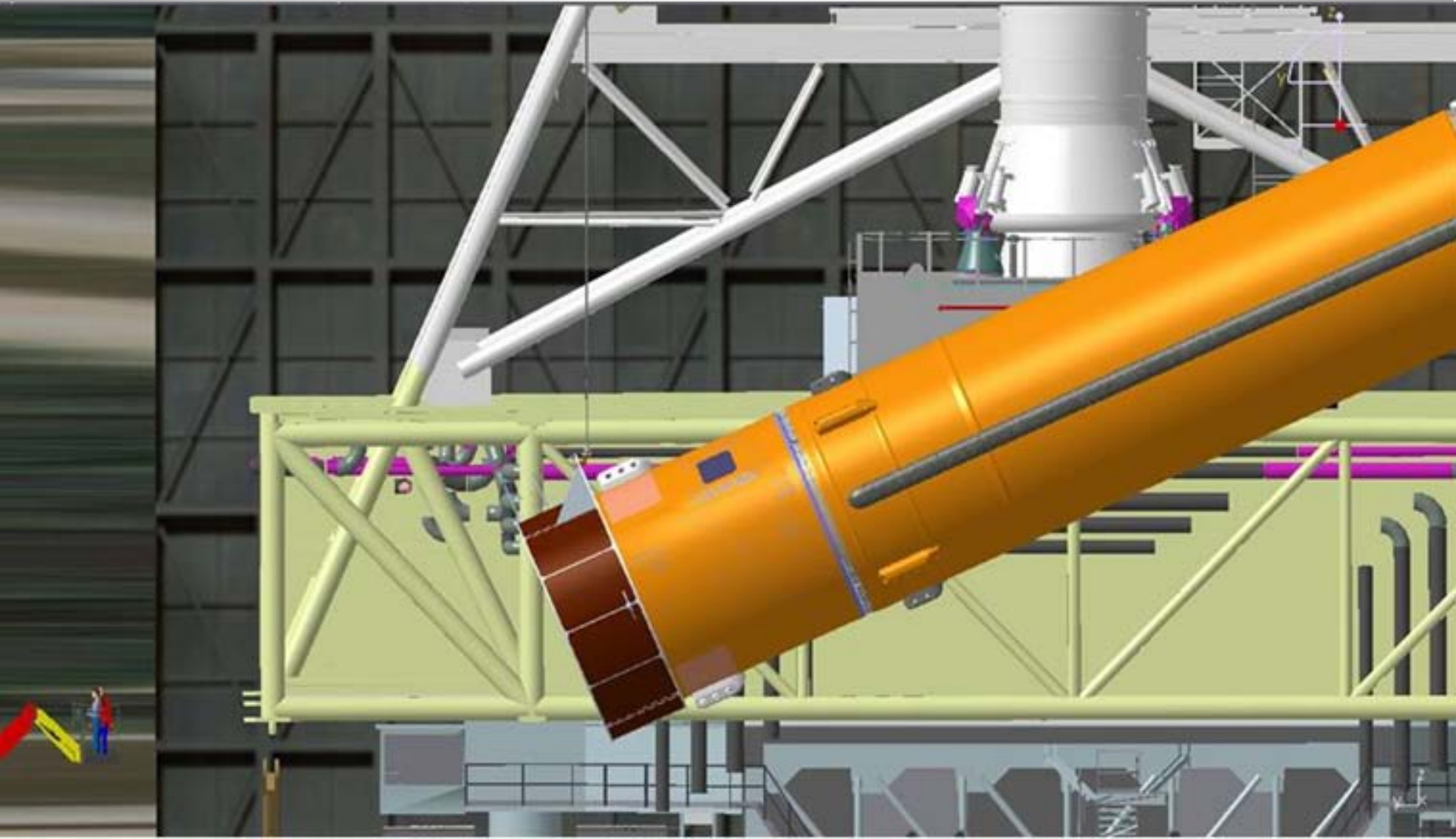


Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



ROTATE HORIZONTAL TO VERTICAL

View 2

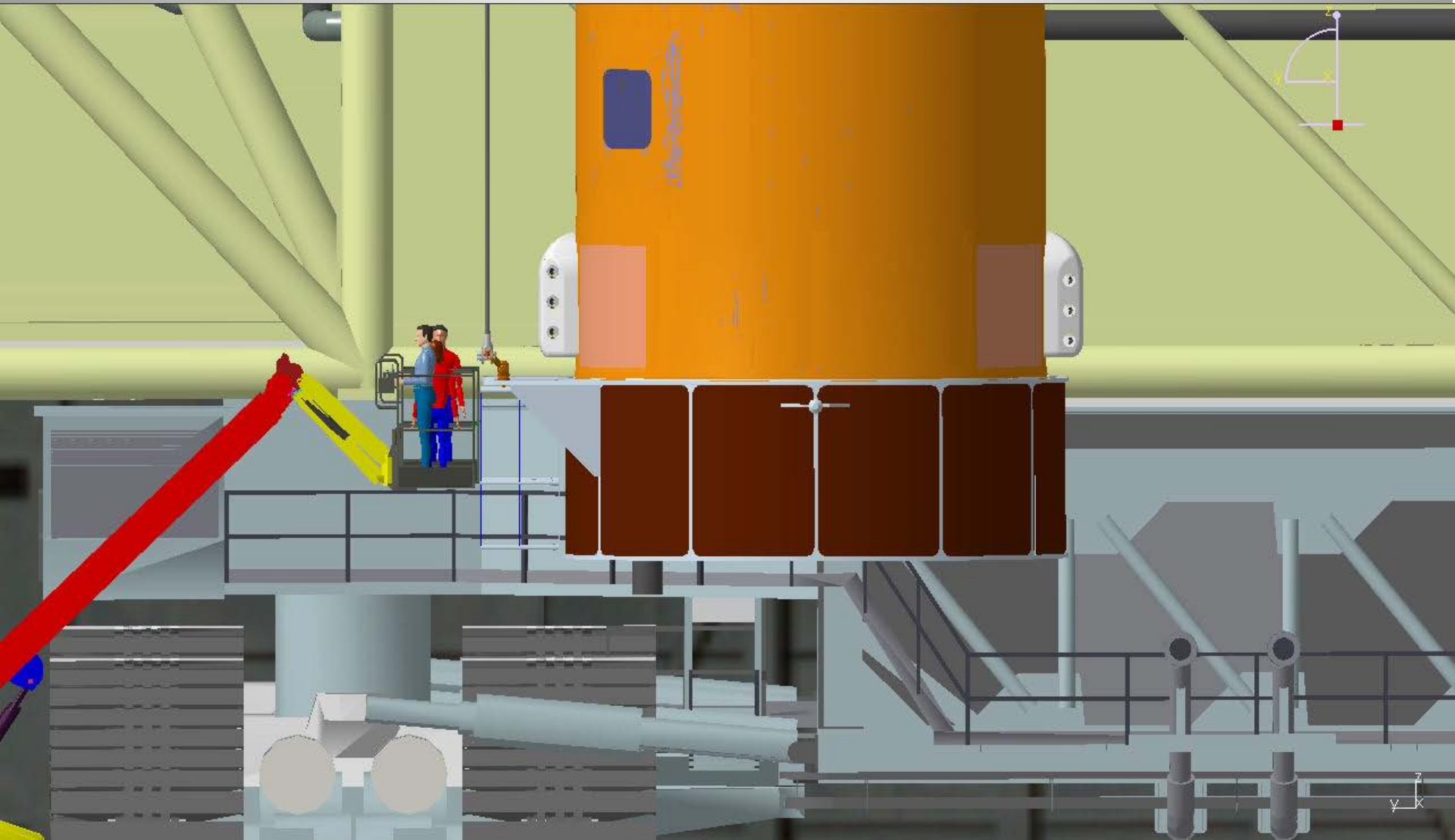




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DISCONNECT REAR BOLT RING CABLING

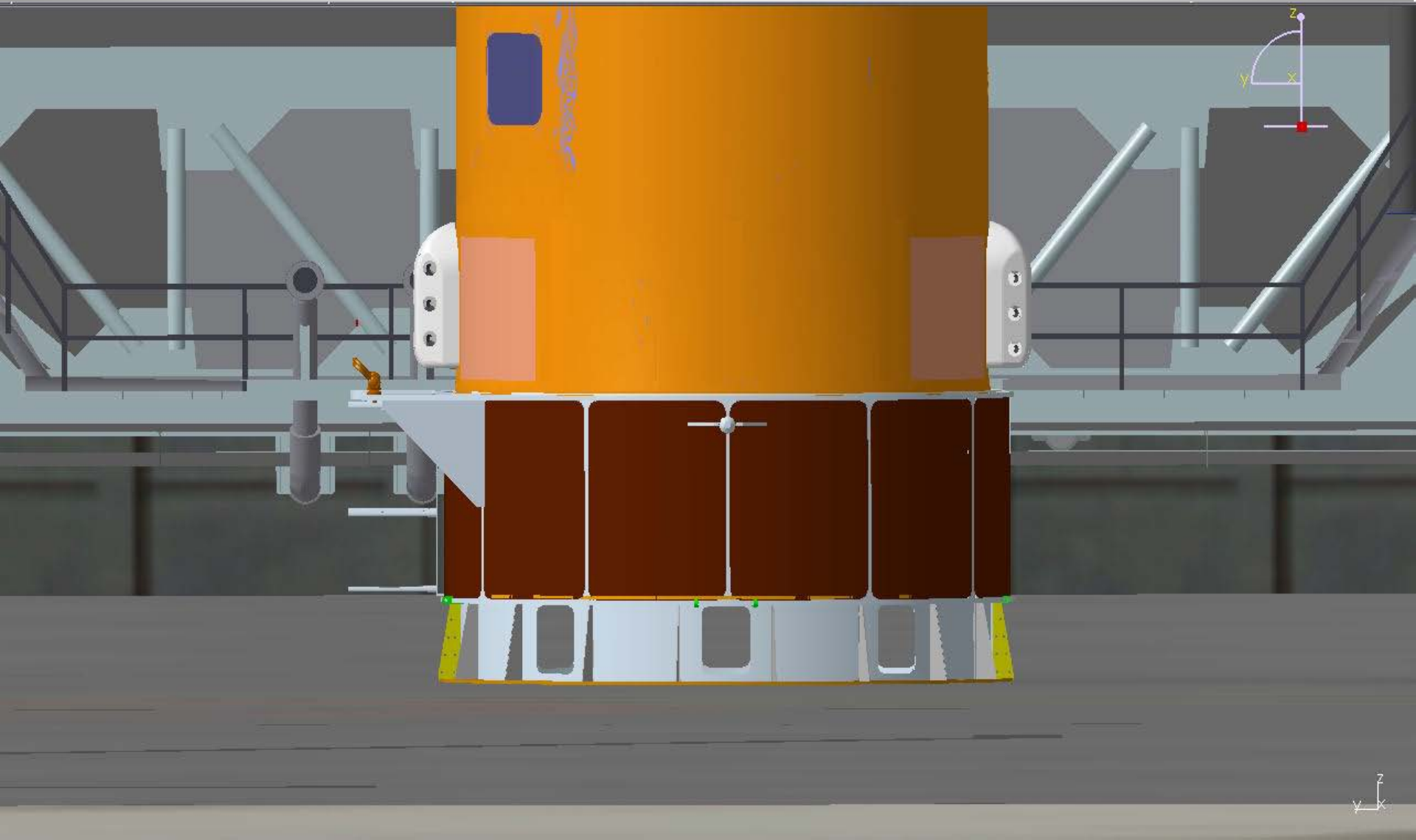




Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



LOWER UPPER STAGE TO INSPECTION STAND

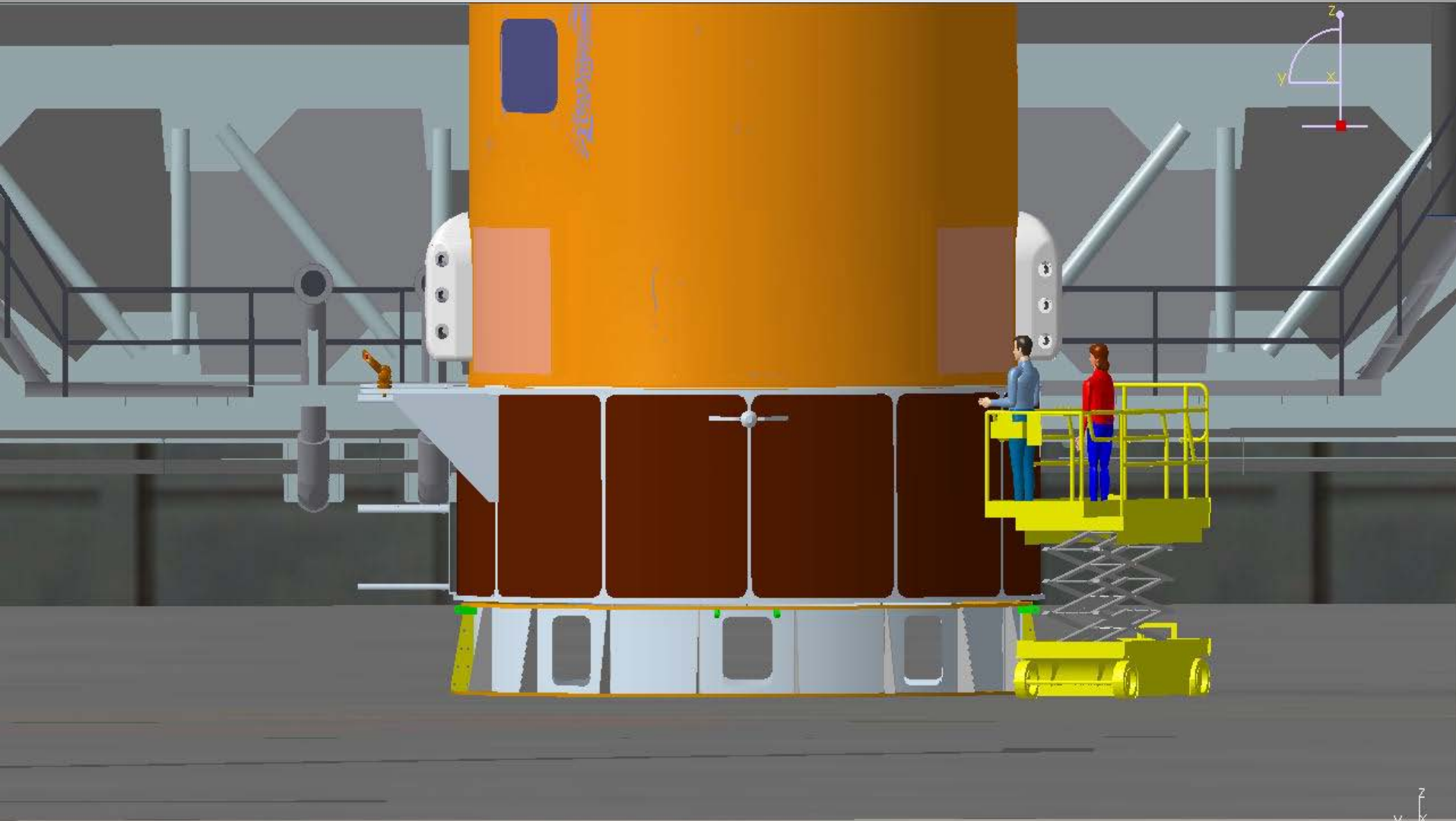




Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



DISCONNECT REAR BOLT RING FROM UPPER STAGE

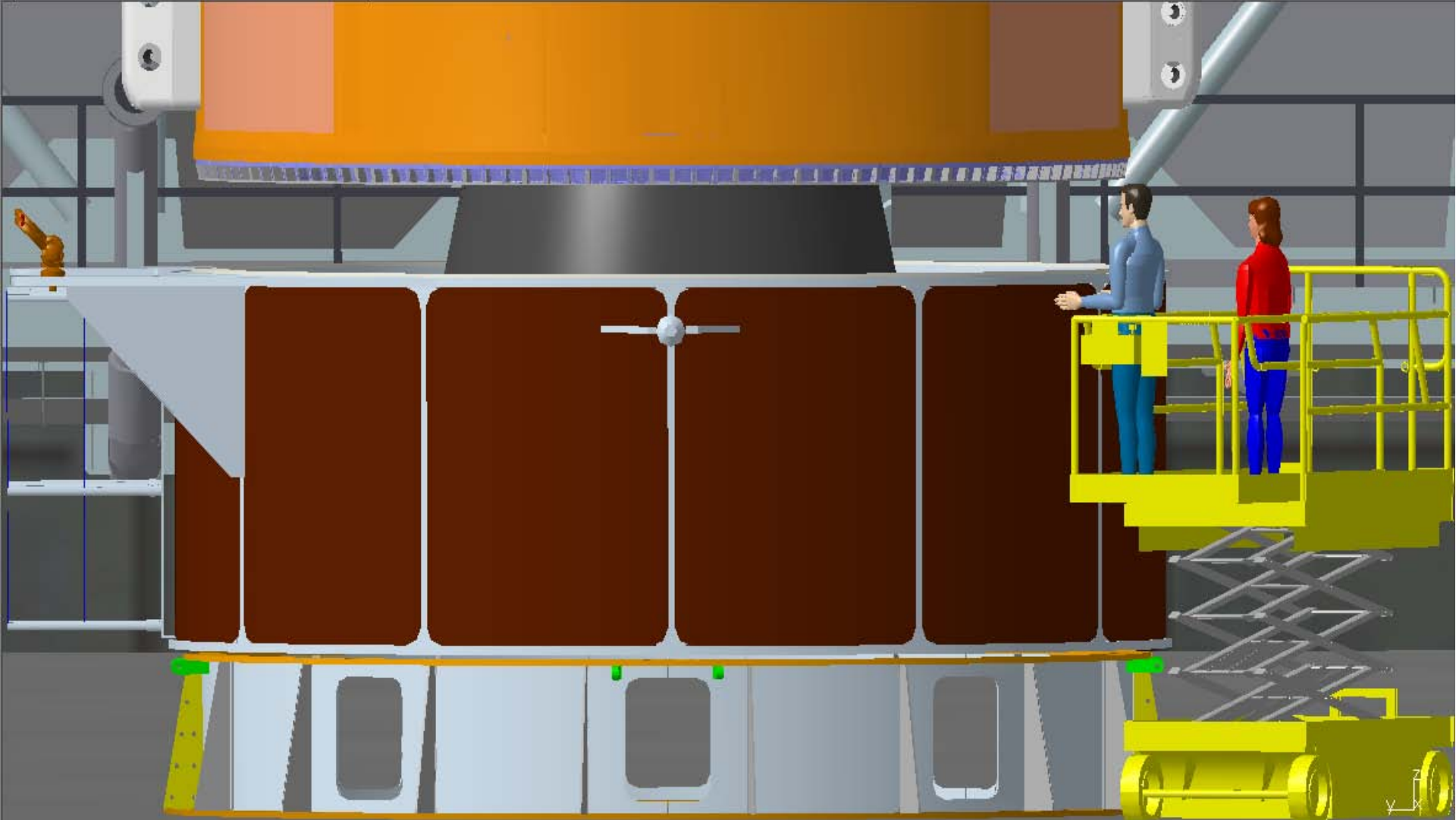




Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



LIFT UPPER STAGE AND INSPECT AFT FANGE

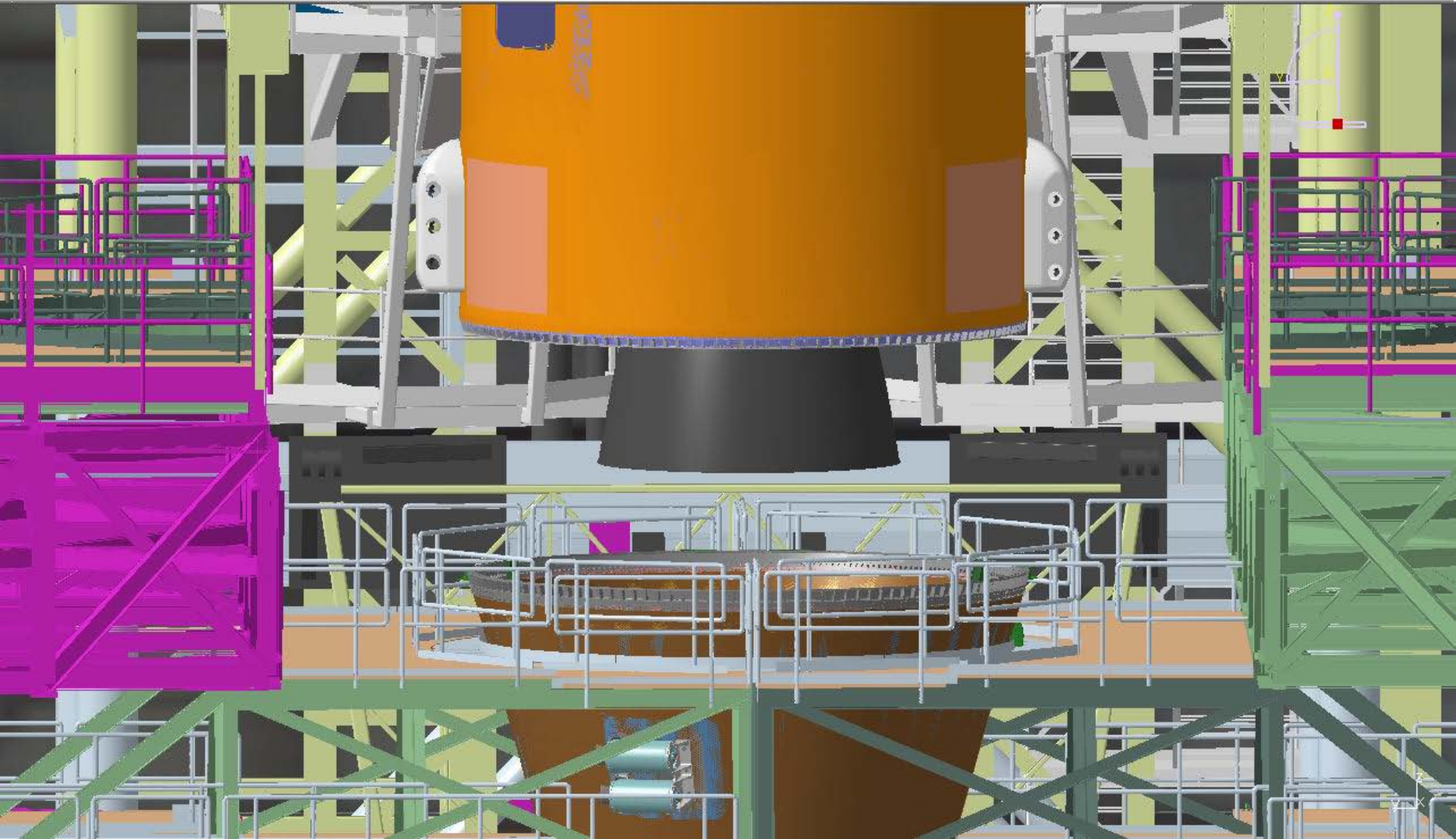




Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



TRANSFER UPPER STAGE TO INTEGRATED STACK



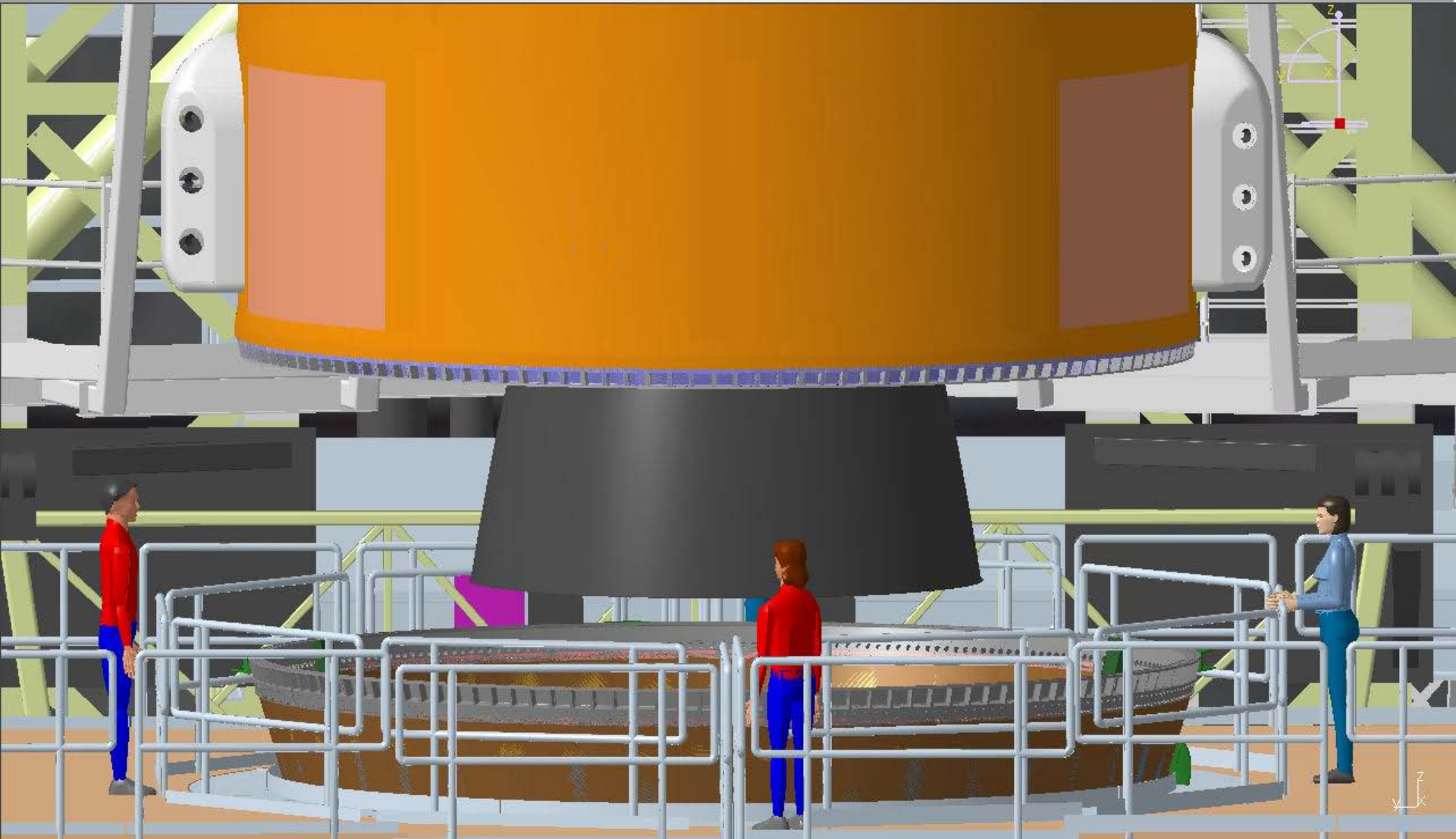


Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



MATE UPPER STAGE TO FIRST STAGE

VIEW 1



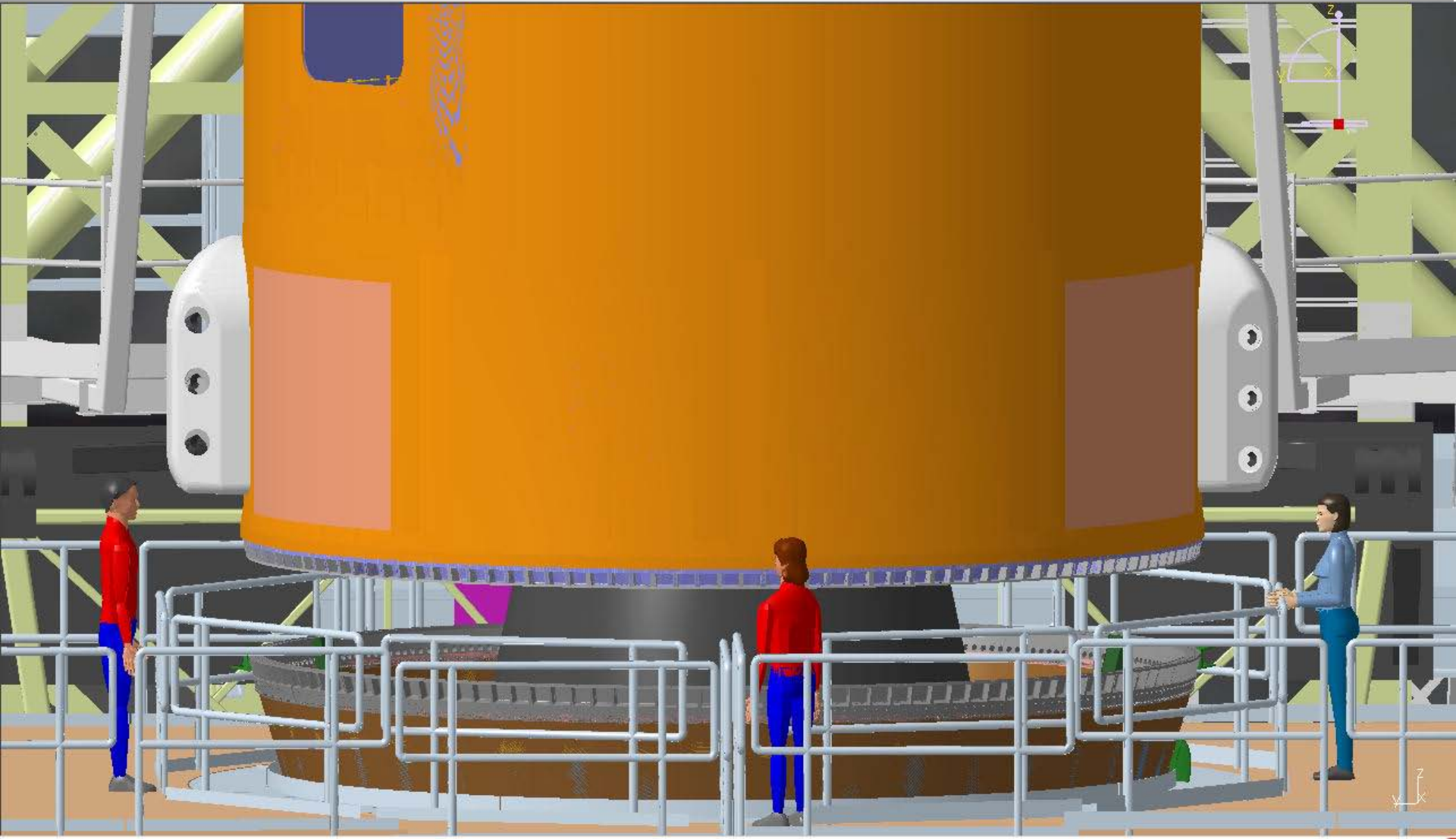


Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



MATE UPPER STAGE TO FIRST STAGE

VIEW 2



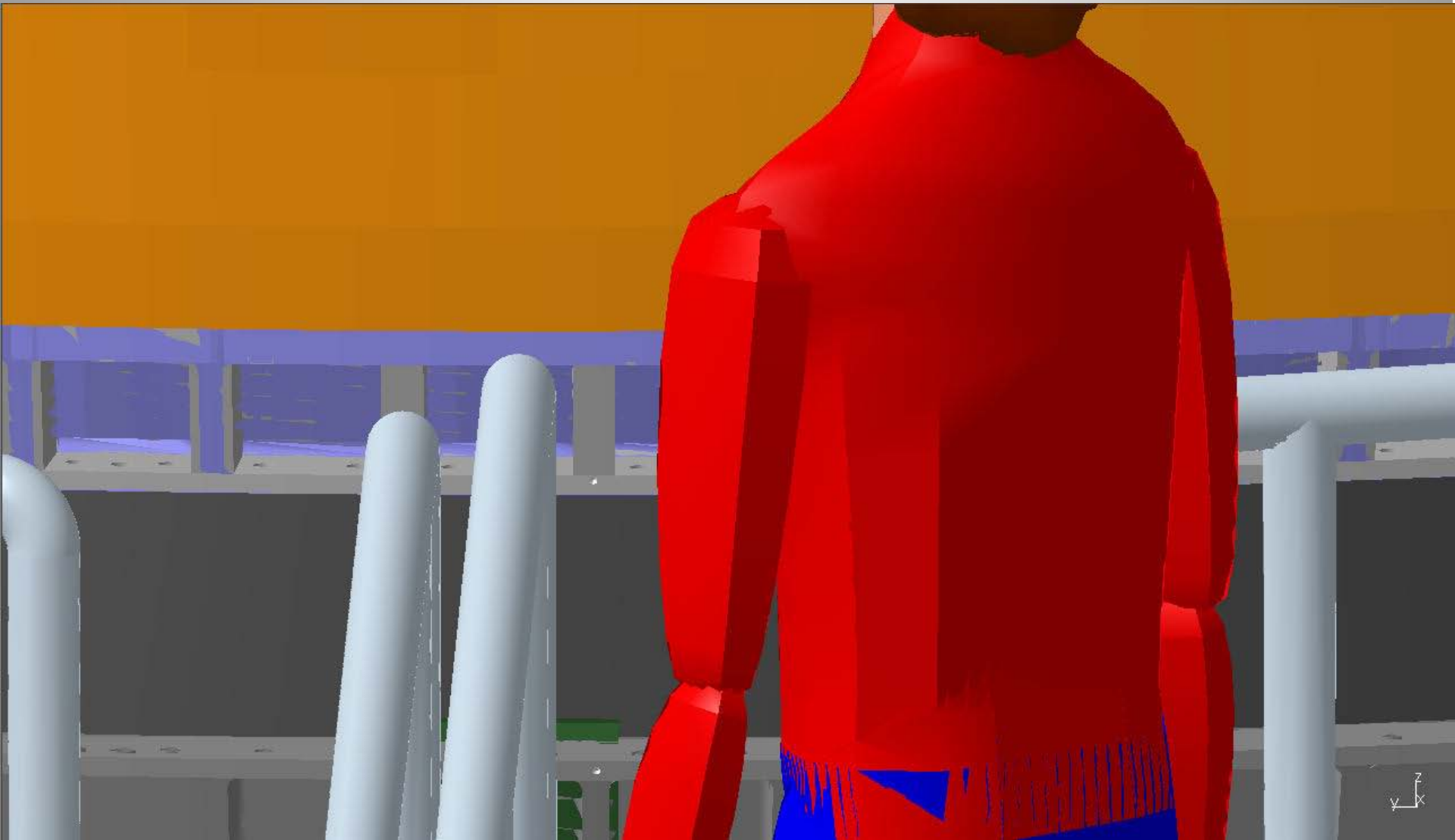


Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



MATE UPPER STAGE TO FIRST STAGE

VIEW 3





Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



MATE UPPER STAGE TO FIRST STAGE

VIEW 4



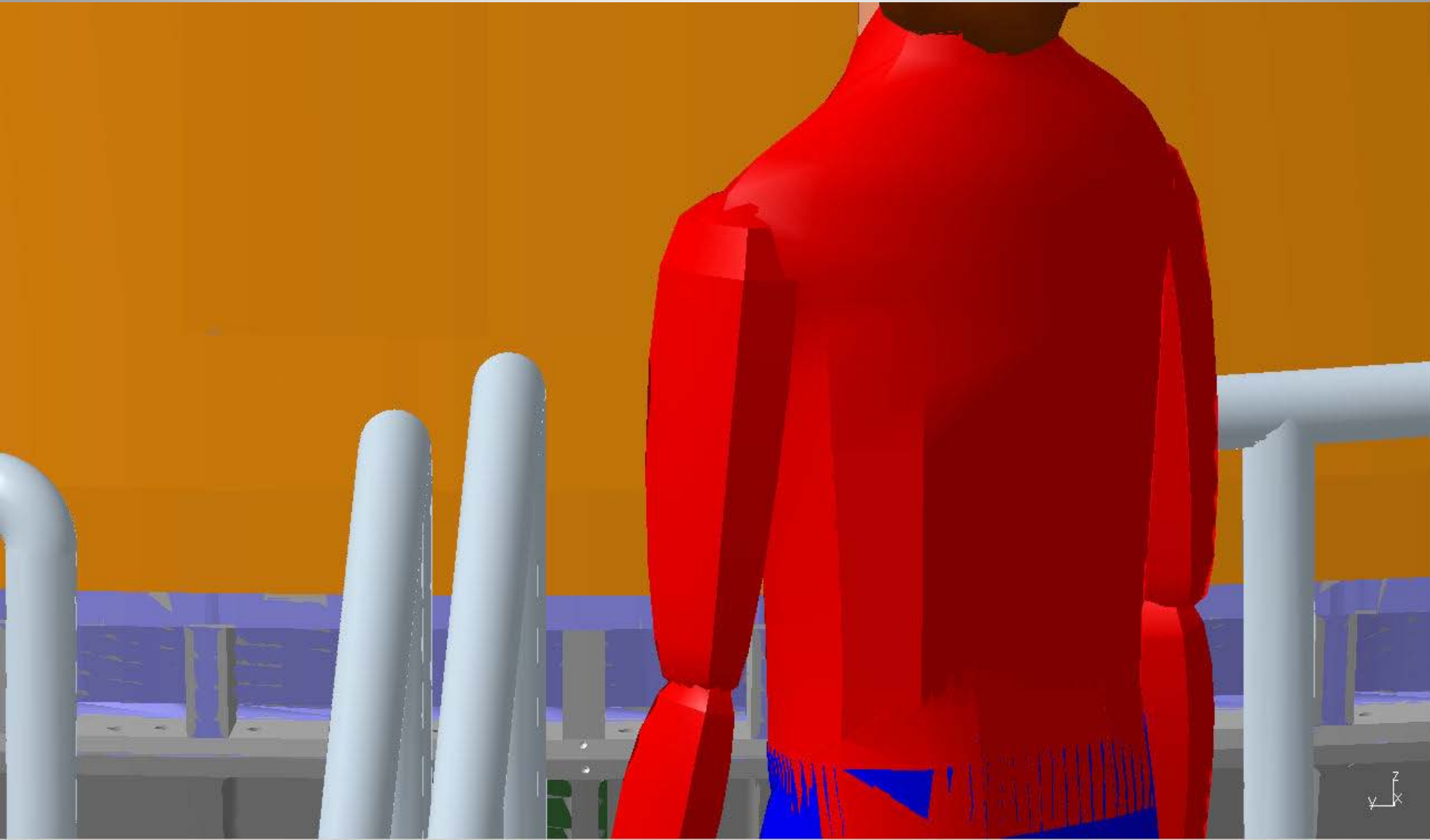


Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



MATE UPPER STAGE TO FIRST STAGE

VIEW 5



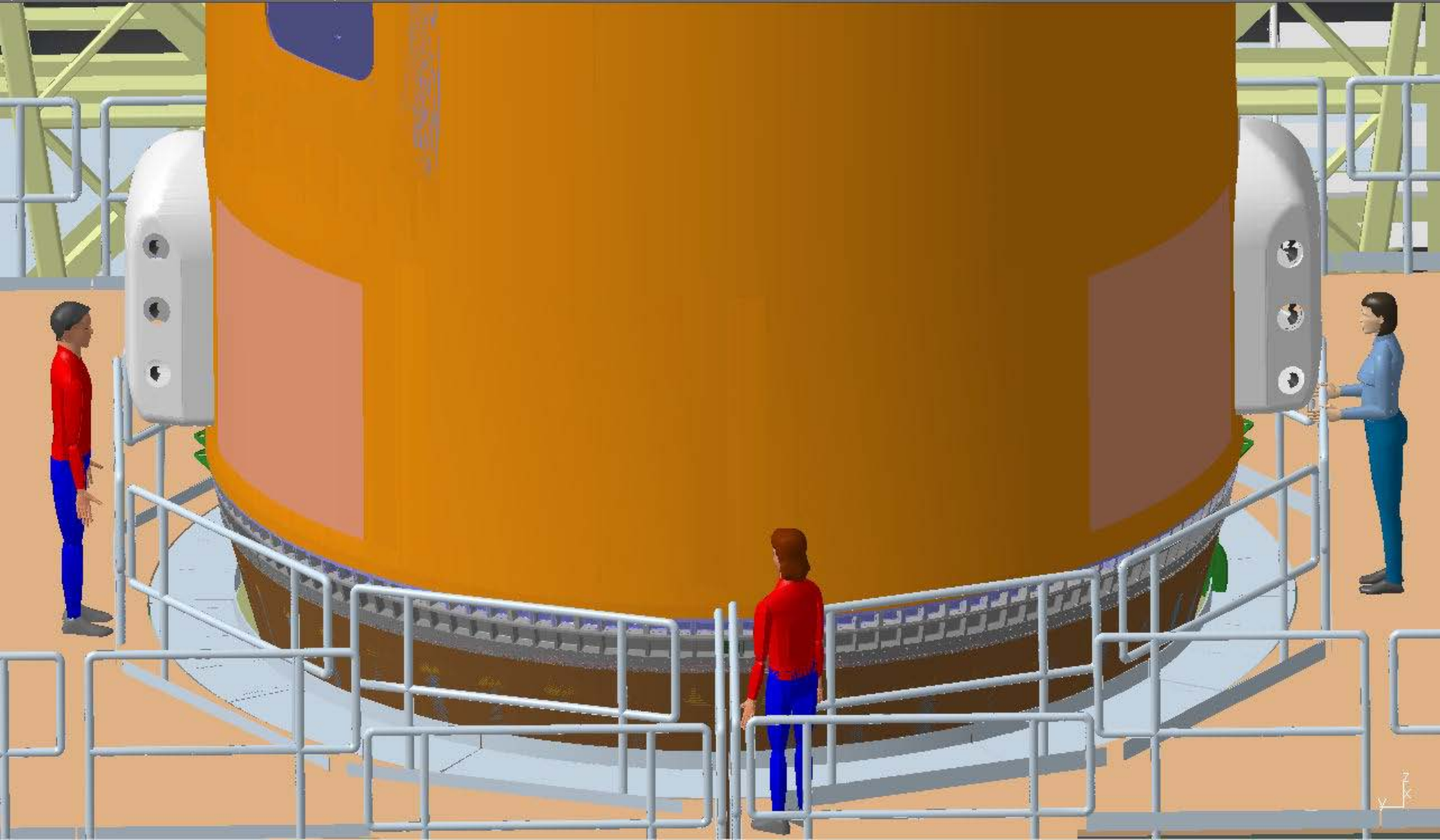


Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



MATE UPPER STAGE TO FIRST STAGE

VIEW 6

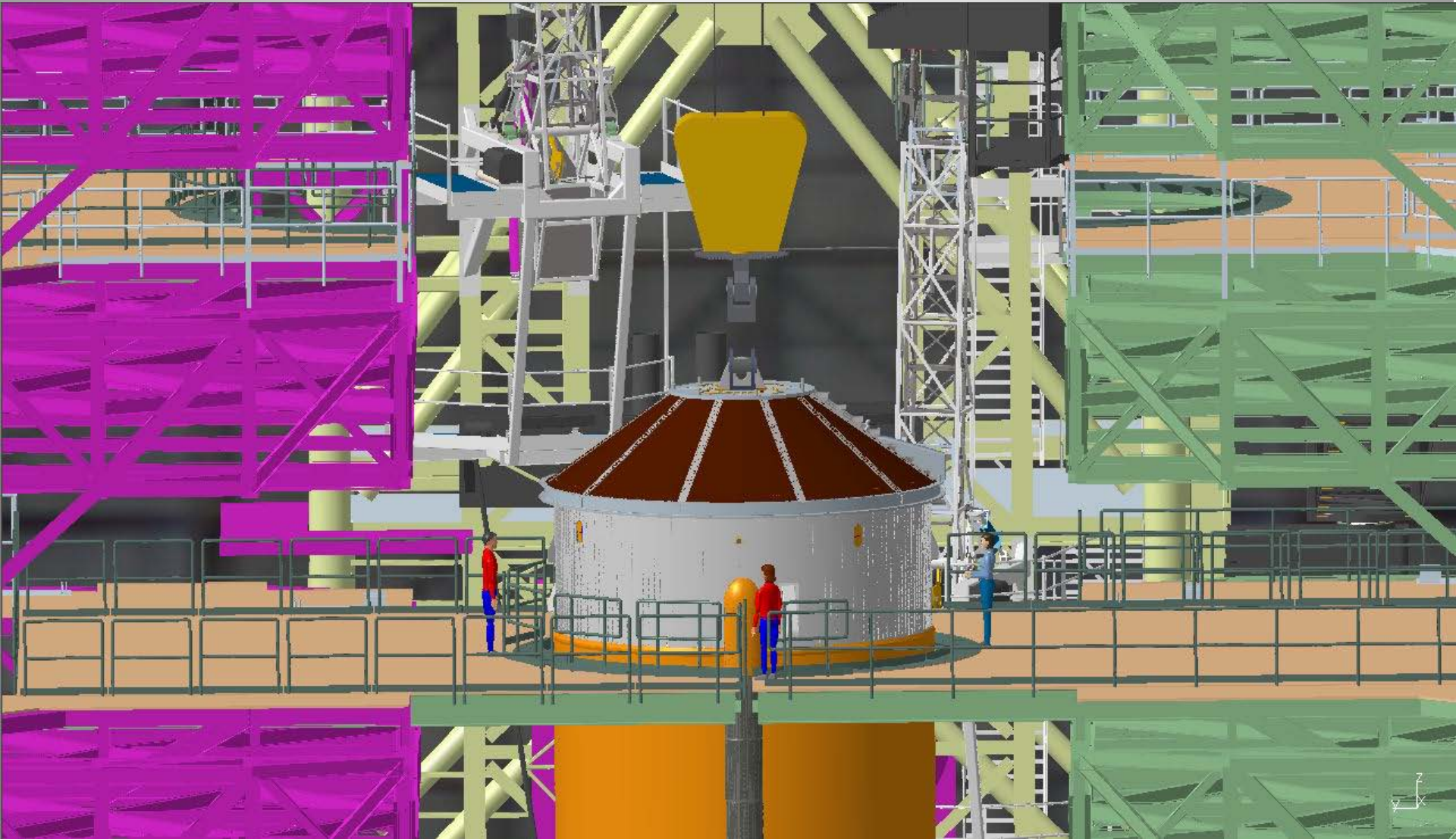




Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



PREPARE THE FORWARD DOME FOR REMOVAL





Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



UNBOLT THE FORWARD DOME FROM THE UPPER STAGE

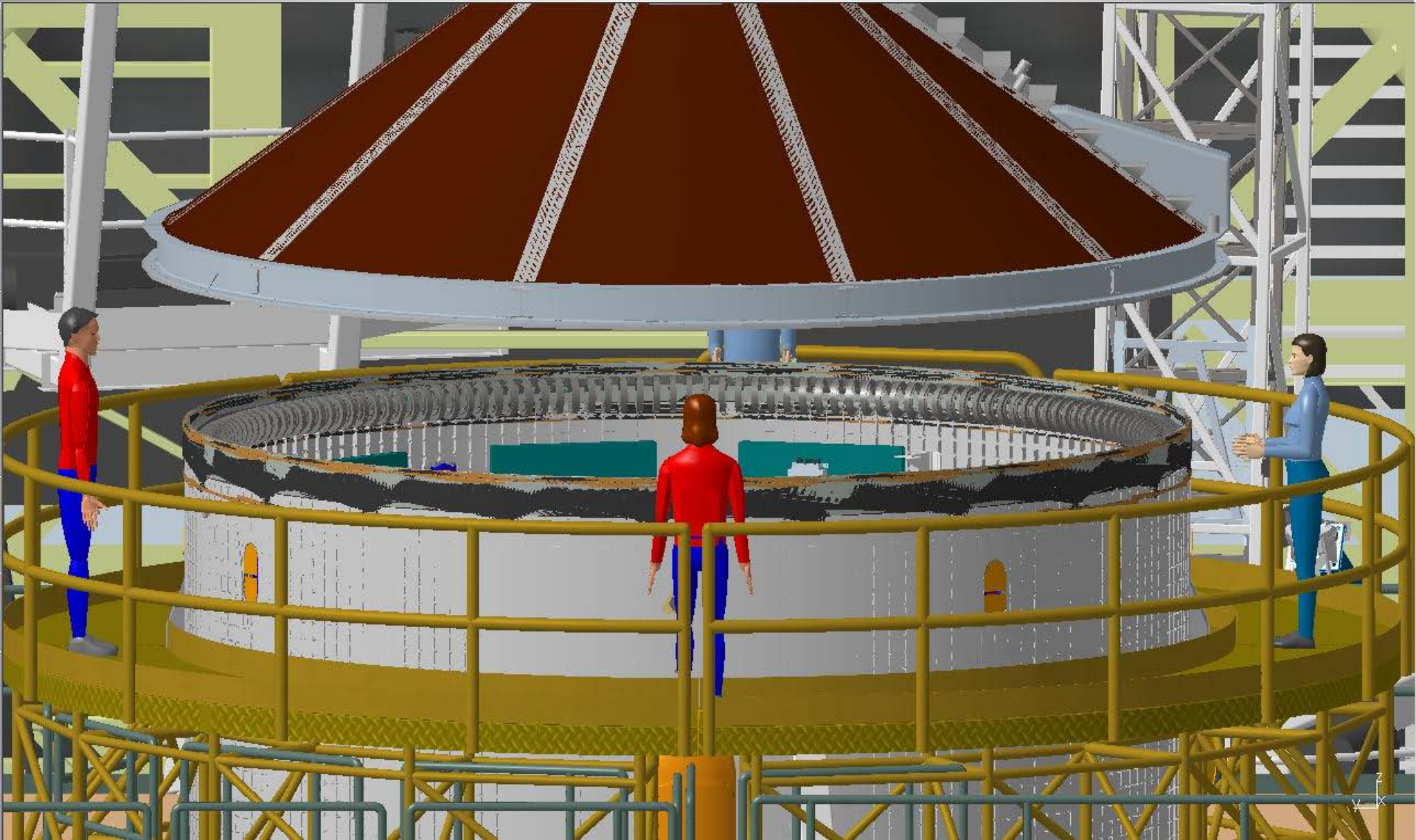




Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



REMOVAL OF THE FORWARD DOME





Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



INSPECTION OF THE FORWARD DOME

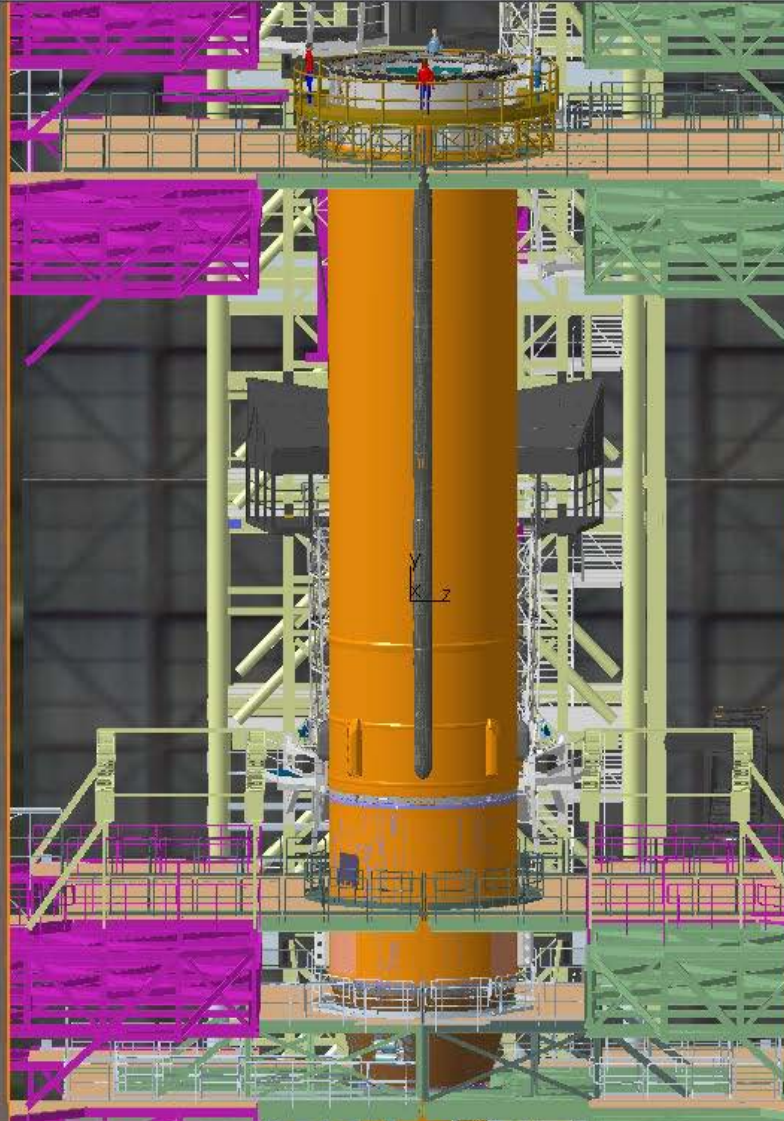




Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



UPPER STAGE MATED ON INTEGRATED STACK





Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



UPPER STAGE MATED ON INTEGRATED STACK AND CRAWLER





Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



ANALYSIS DESCRIPTION



- Based on the A104 configuration, personnel will be able to get within a range of $\sim .305\text{ft}$ ($3.66''$) to the outer mold line (OML) of the Crew Launch Vehicle (CLV) to access the Electrical Interface Panel via the Interstage porthole.
- The analysis will be conducted with both the 5thtile American female* and 95thtile American male* standing at a distance of $.815\text{ft}$ ($9.78''$) from the OML of the vehicle.

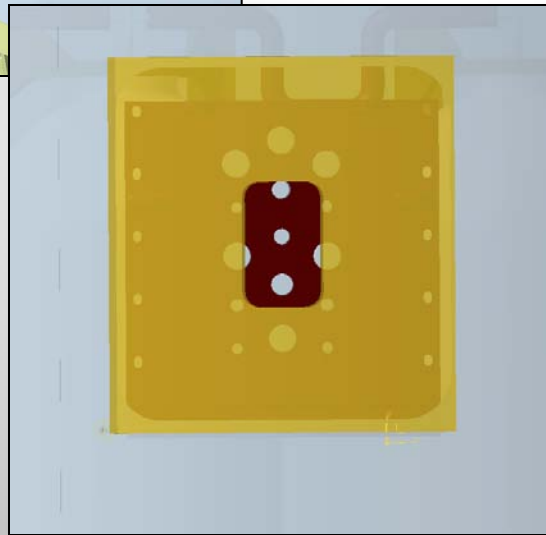
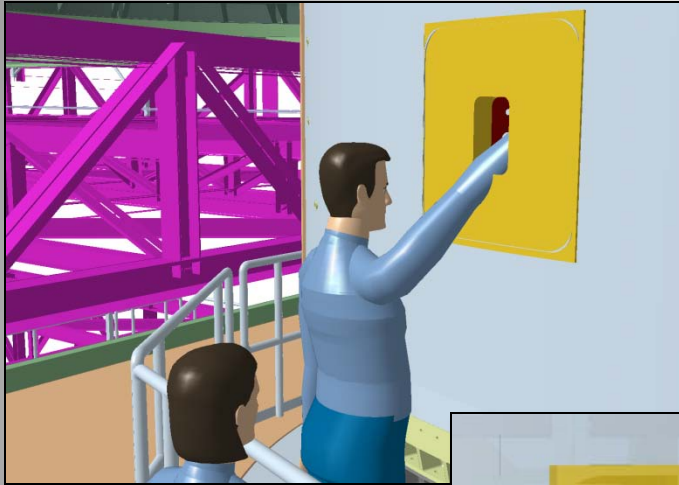
* 1988 ANSUR



Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



ANALYSIS DESCRIPTION (8" x 5" / 2" Corner Radii)



REASONING

- Clearance size was generated from the minimal clearance for tool-operated fasteners requirement of NASA-STD-3000.

INITIAL PERCEPTION

- *Limits access to outside, upper, and lower rows of connectors*
- *Limits visual access*

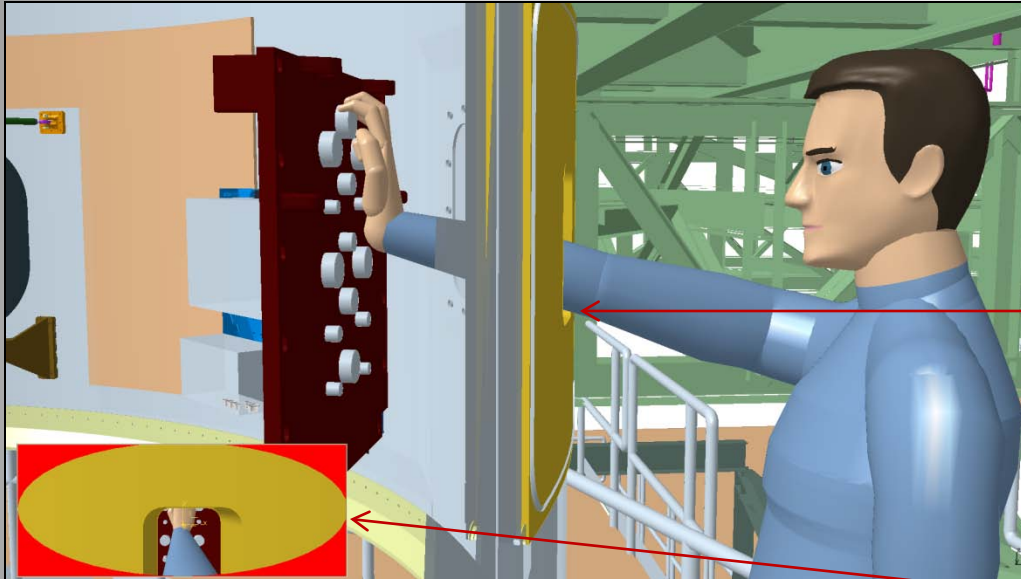


Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



ANALYSIS DESCRIPTION (8" x 5" / 2" Corner Radii)

95thtile American Male



- The 8" x 5" opening does not allow physical access to all electrical panel connectors.
- The 8" x 5" opening does not allow much arm room to alter arm positions for access to lower connectors.
(~1.2" total width clearance for male)

- The 8" x 5" opening does not allow direct line of sight visual access to all electrical panel connectors, especially with arm through porthole.

- Visual access to support strut attachments is not granted.

- Although altering the height and position of personnel would likely provide a line of sight to needed areas, adequate physical access would be denied.

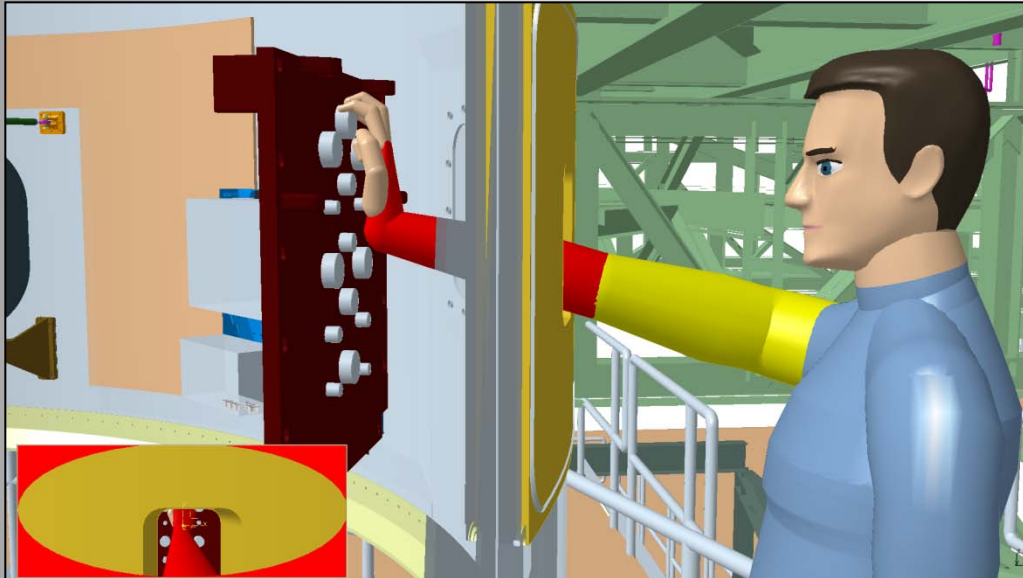


Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC

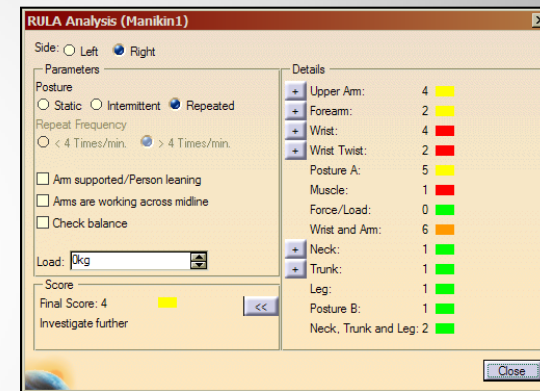
ANALYSIS DESCRIPTION (RULA ANALYSIS)



95thtile American Male



RULA ANALYSIS



■ A Rapid Upper Limb Assessment (RULA)*

analysis was performed; this posture generates a recommendation for further investigation for a more favorable posture

■ Negatively Impacted Areas:

- Wrist
- Wrist and Arm

•RULA =>

Method for analyzing risk factors to the upper extremities of the human in the actual physical environment.

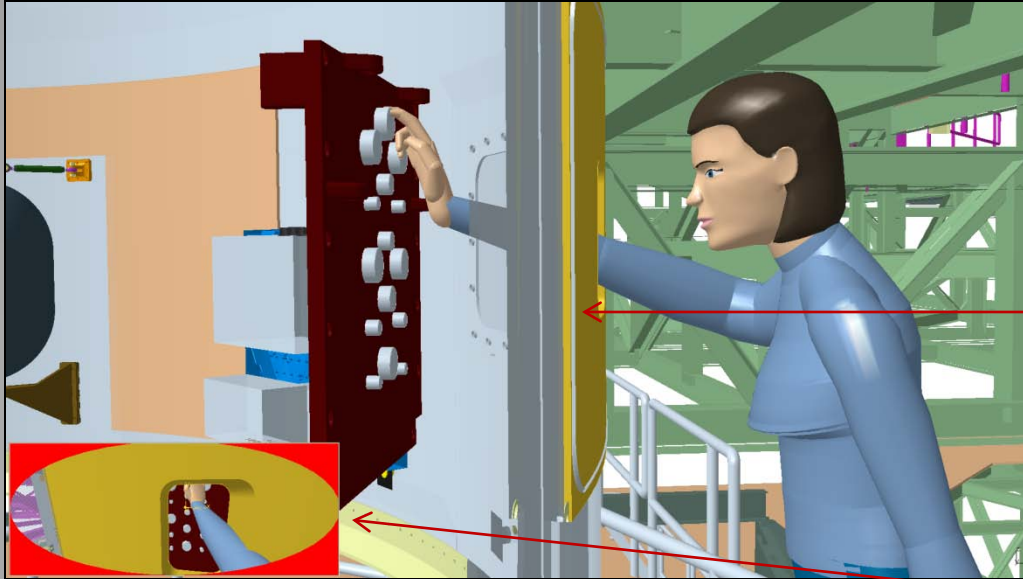


Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



ANALYSIS DESCRIPTION (8" x 5" / 2" Corner Radii)

5thtile American Female



- The 8" x 5" opening does not allow physical access to all electrical panel connectors. The 8" x 5" opening does not allow adequate arm room to alter arm positions for access to lower connectors. (~1.66" total width clearance for female)

- The 8" x 5" opening does not allow direct line of sight visual access to all electrical panel connectors.

- Visual access to support strut attachments is not granted.

- Although altering the height and position of personnel would likely provide a line of sight to needed areas, adequate physical access would be denied.

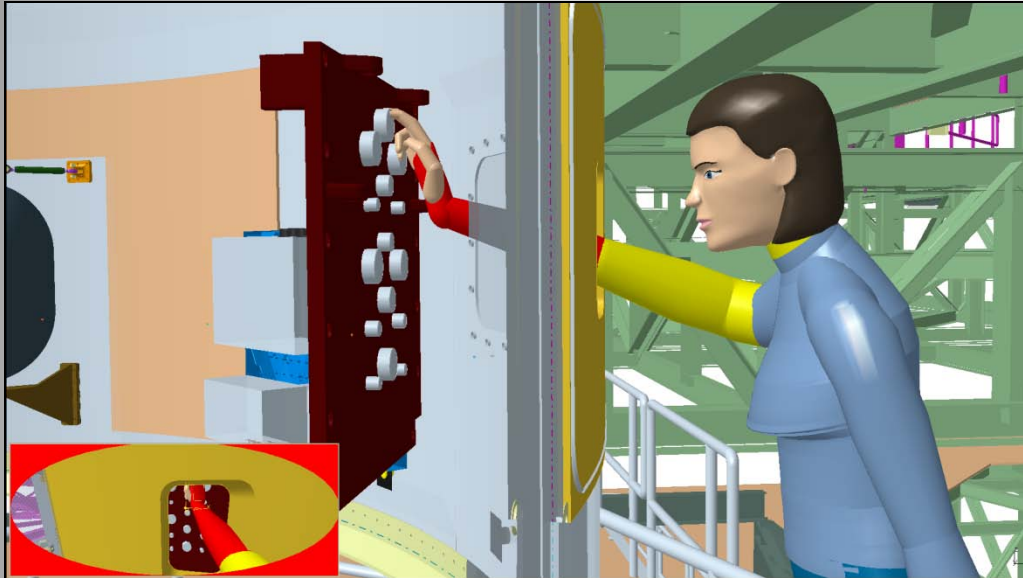


Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC

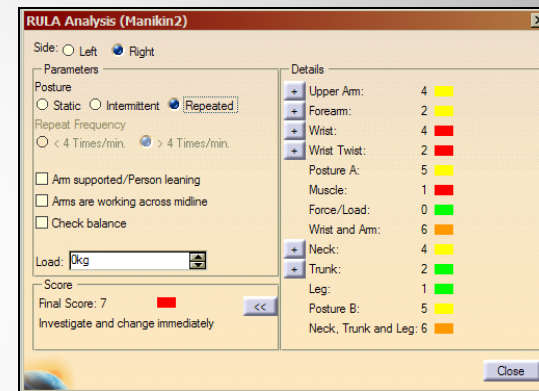


ANALYSIS DESCRIPTION (RULA ANALYSIS)

5th%tile American Female



RULA ANALYSIS



■ A RULA analysis was performed; this posture generates a recommendation to investigate and change immediately for a more favorable posture.

■ Negatively Impacted Areas:

- Wrist
- Wrist and Arm
- Neck, Trunk and Leg

■ The 5th%tile American female torso was extended ~15deg in order to reach the top connector.

■ The 5th%tile American female will be able to reach connectors and the top of electrical panel without leaning through the Interstage porthole.

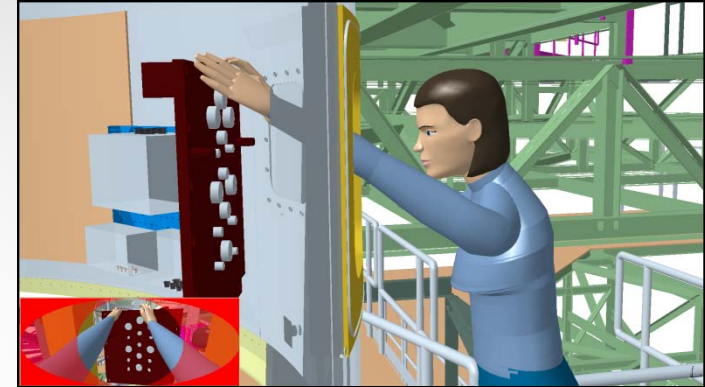
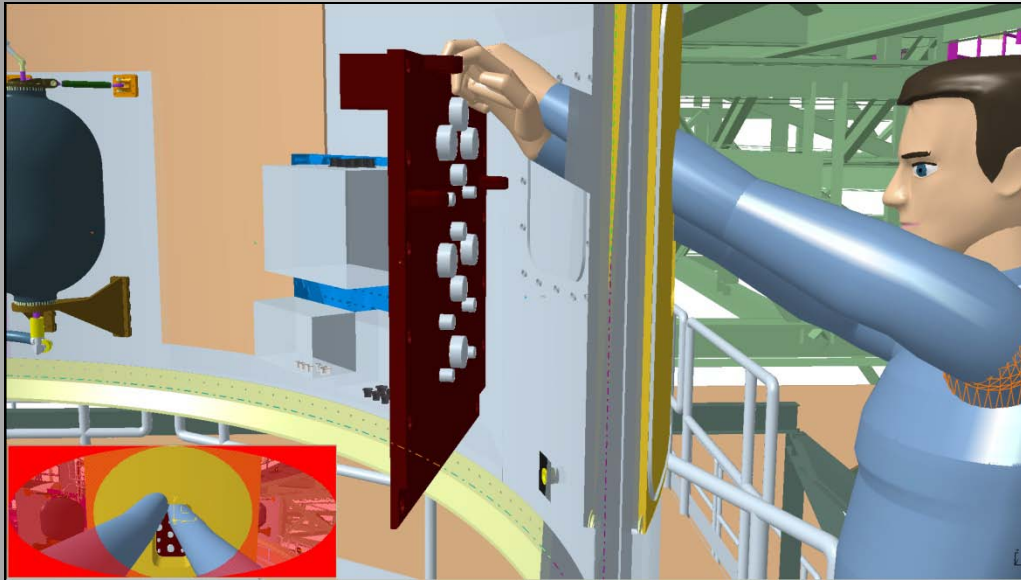


Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



ANALYSIS DESCRIPTION (8" x 5" Two-Handed Operation)

95thtile American Male & 5thtile American Female



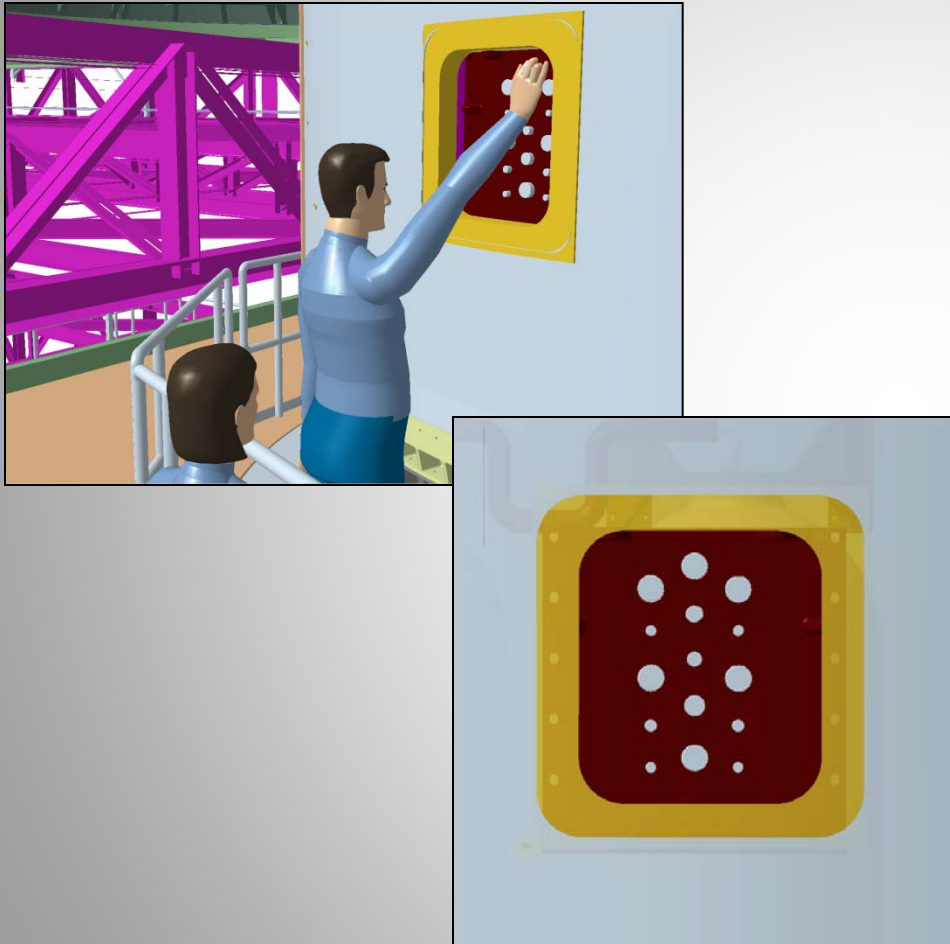
- The 8" x 5" porthole does not provide sufficient clearance to allow possible two-handed operations.
- Support structure tasks would likely be impossible.
- Both male and female personnel are able to reach the top of the electrical panel with two hands without leaning through the porthole.



Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



ANALYSIS DESCRIPTION (18" x 16" / 3" Corner Radii)



REASONING

- Clearance size was taken from the Ares I Upper Stage to First Stage Interface Control Document (ICD) [CxP 72261]
- The 18" x 16" opening was used in the previous HFE analysis of the horizontal oriented electrical panel and proved to provide sufficient access to the horizontal oriented panel.
- Provides the capability to add additional connectors if needed
- Provides physical access and direct line of sight to all electrical panel connectors.

INITIAL PERCEPTION

- *Provides access to all connectors and top of electrical panel*
- *Provides ample visual access*



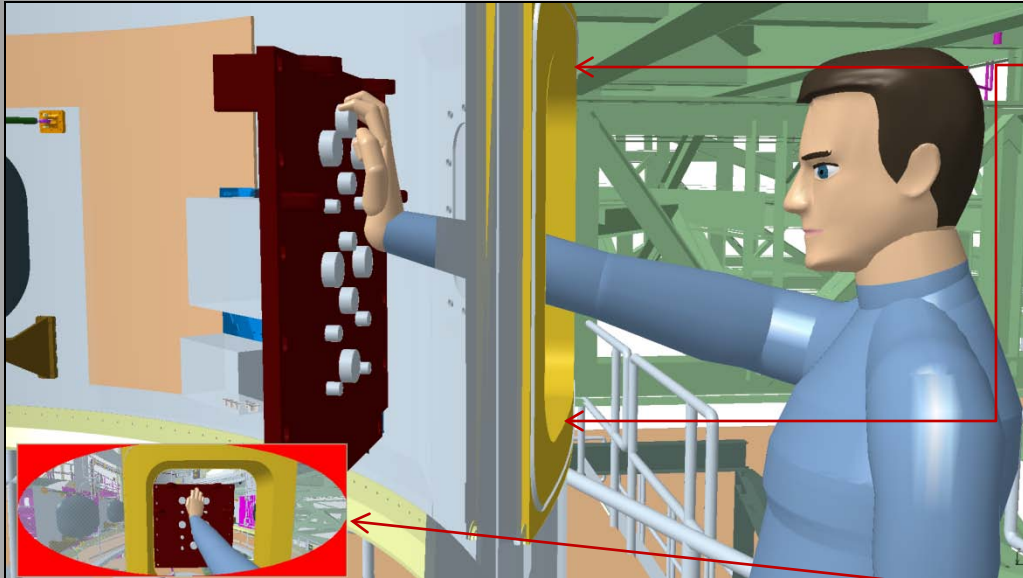
Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



ANALYSIS DESCRIPTION (18" x 16" / 3" Corner Radii)



95thtile American Male



- The 18" x 16" opening allows physical access to all electrical panel connectors. The 18" x 16" opening also allows sufficient arm room to alter arm positions for access to lower connectors. (~12.2" total width clearance for male)
(~12.6" total width clearance for female)

- The 18" x 16" opening allows a direct line of sight visual access to all electrical panel connectors with arm through porthole.

- Physical access and a direct line of sight to support strut attachments is granted.

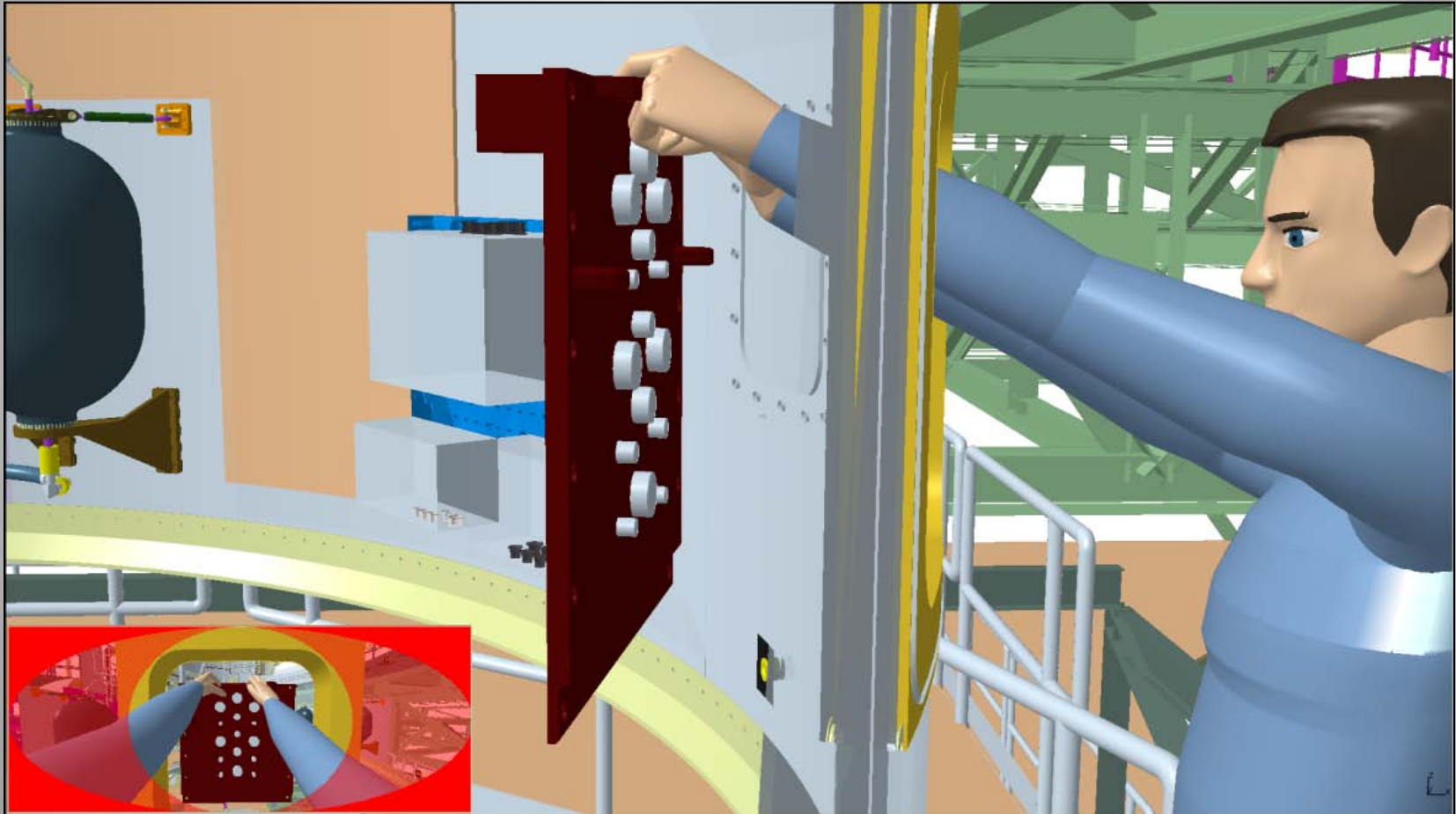


Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



ANALYSIS DESCRIPTION (18" x 16" Two-Handed Operation)

95thtile American Male



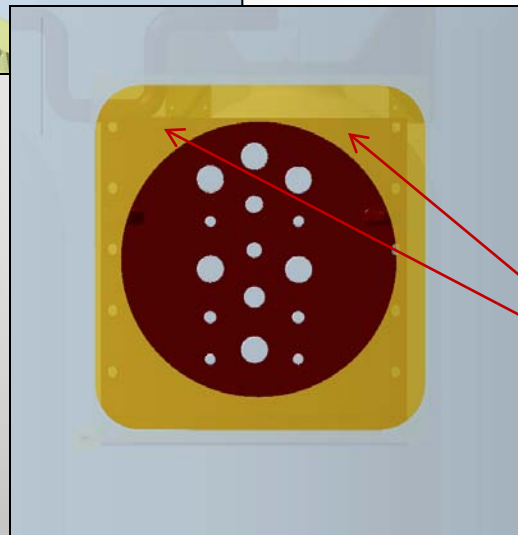
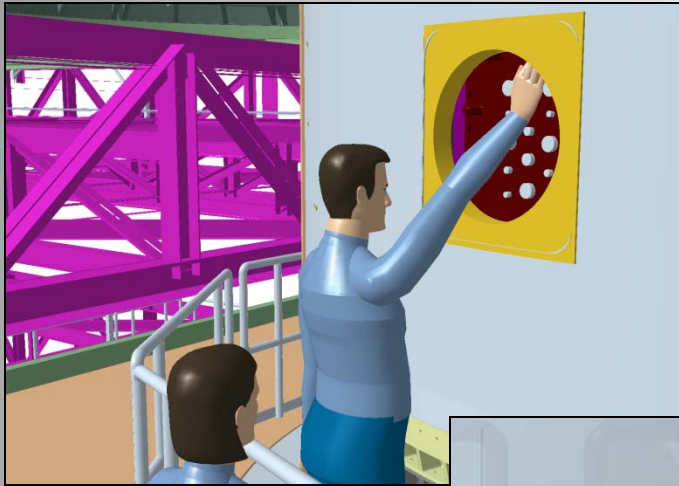
- The 18" x 16" porthole does provide sufficient clearance to allow possible two-handed operations.



Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



ANALYSIS DESCRIPTION (18" Diameter)



REASONING

- Clearance size was a point of interest that incorporated the 18" clearance from the Ares I US to FS ICD [CxP 72261]; and also satisfies the desire for the porthole to be "as round as possible"

INITIAL PERCEPTION

- *Provides access to all connectors and top of electrical panel*
- *Provides ample visual access*
- *Could possibly reduce ability to access top of electrical panel for attachment of support struts, etc...*
- *Possible physical pressure point for corner connectors*

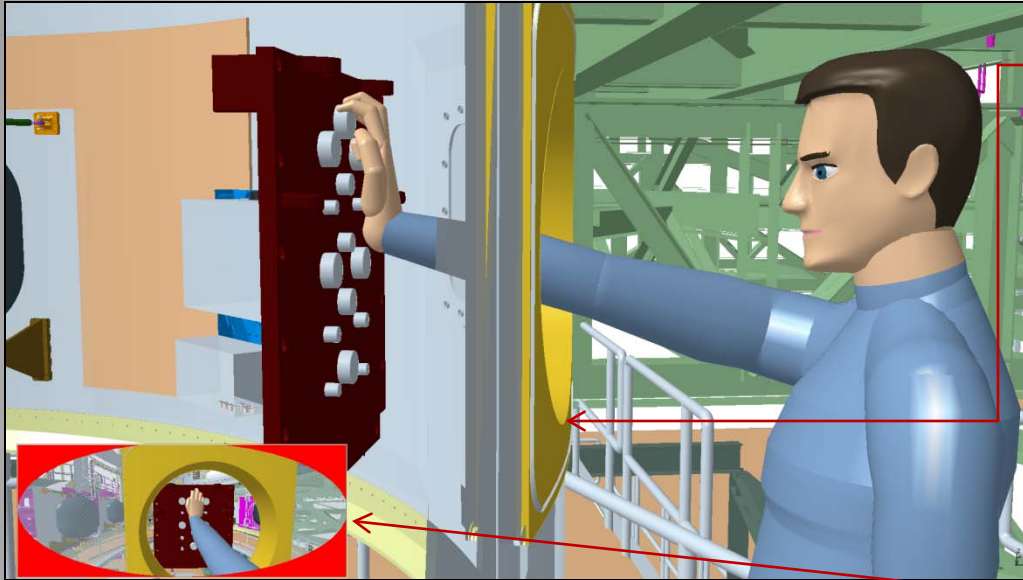


Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



ANALYSIS DESCRIPTION (18" Diameter)

95thtile American Male



- The 18" diameter opening allows physical access to all electrical panel connectors. The 18" diameter opening also allows sufficient arm room to alter arm positions for access to lower connectors.
(~14.2" total clearance for male)
(~14.66" total clearance for female)

- The 18" diameter opening allows a direct line of sight visual access to all electrical panel connectors.
- Physical access and a direct line of sight to support strut attachments is granted.



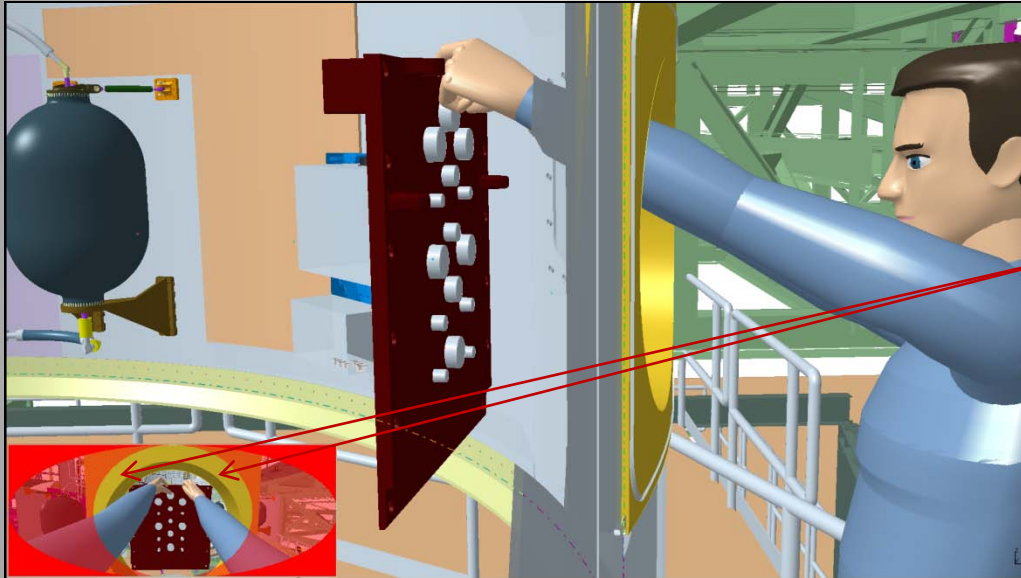
Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



ANALYSIS DESCRIPTION (18" Diameter Two-Handed Operation)



95thtile American Male



- The 18" diameter porthole does provide sufficient clearance to allow possible two-handed operations.

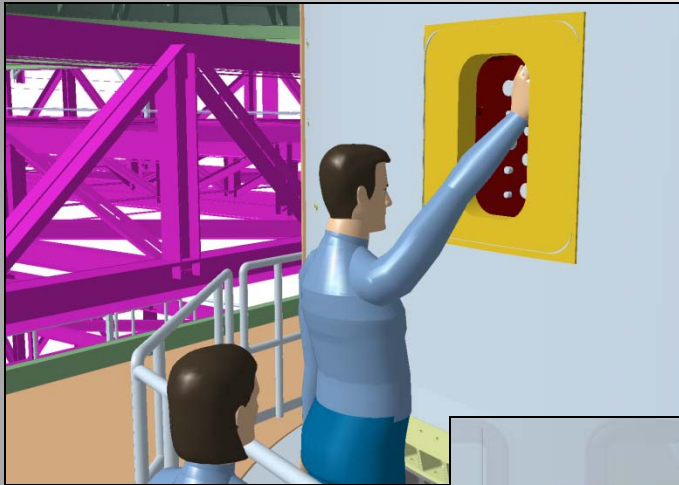
- Diameter/round shaped porthole has the potential to reduce the capability to access top of electrical panel; the lesser the diameter the less access is provided to the electrical panel.



Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



ANALYSIS DESCRIPTION (17" x 10" / 3" Corner Radii)



REASONING

- Size was generated from the dimensions of the actual footprint of the connector layout (see slide 9) and adding an additional 1" to outside edge. The thought was that no additional connectors would be added to the layout.

INITIAL PERCEPTION

- *Provides access to all connectors and top of electrical panel*
- *Provides visual access*



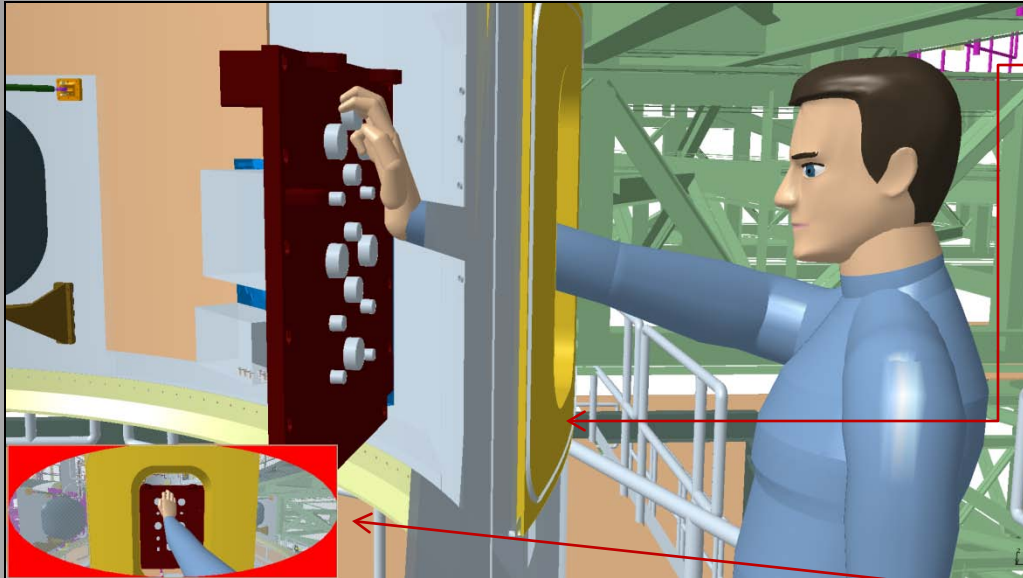
Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



ANALYSIS DESCRIPTION (17" x 10" / 3" Corner Radii)

JACOBS

95thtile American Male



- The 17" x 10" opening allows physical access to all electrical panel connectors. The 17" x 10" opening also allows sufficient arm room to alter arm positions for access to lower connectors. (~6.2" total width clearance for male)
(~6.66" total width clearance for female)

- The 17" x 10" opening allows a direct line of sight visual access to all electrical panel connectors.

- Physical access and a direct line of sight to support strut attachments is granted.

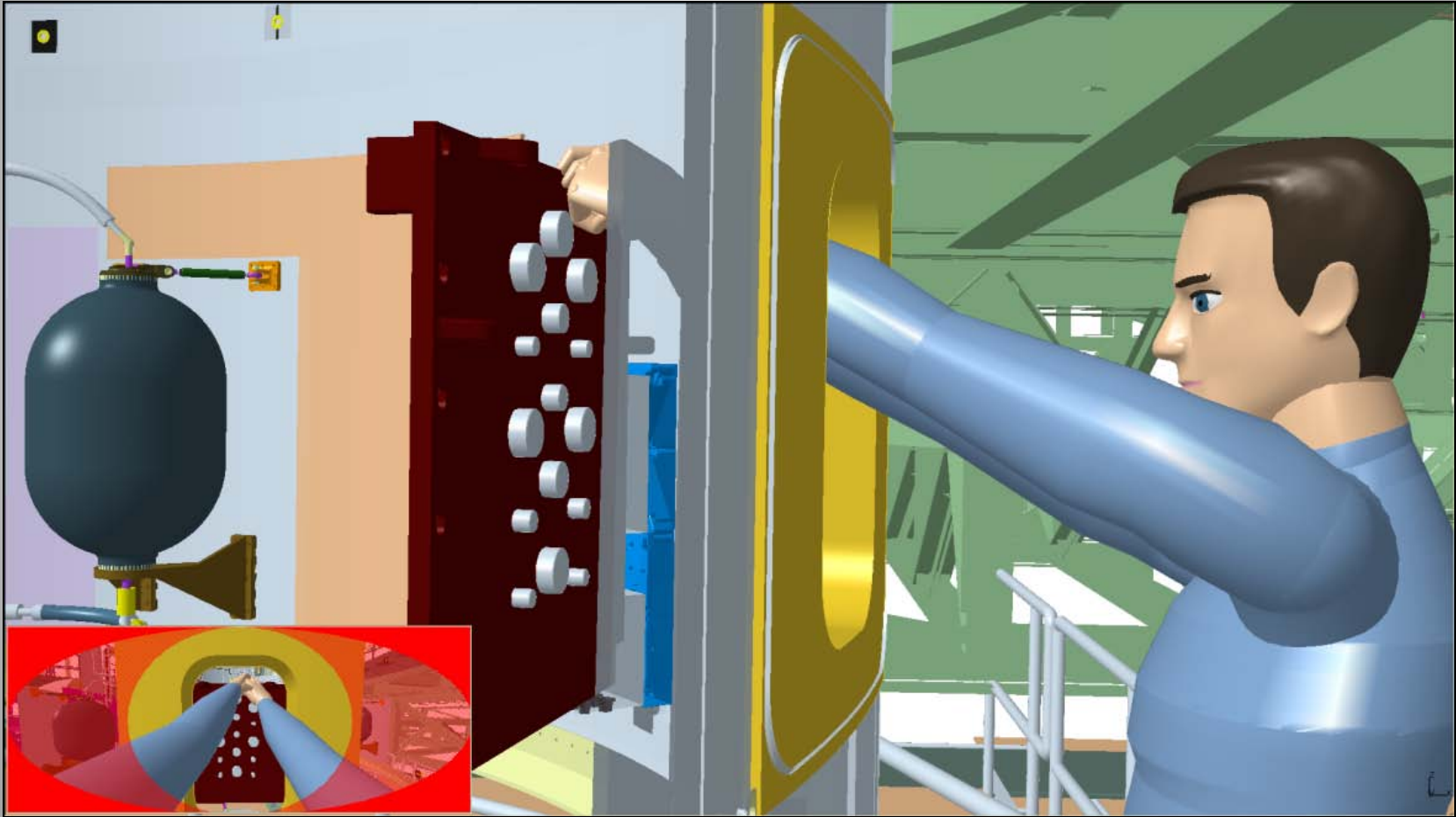


Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



ANALYSIS DESCRIPTION (17" x 10" Diameter Two-Handed Operation)

95thtile American Male



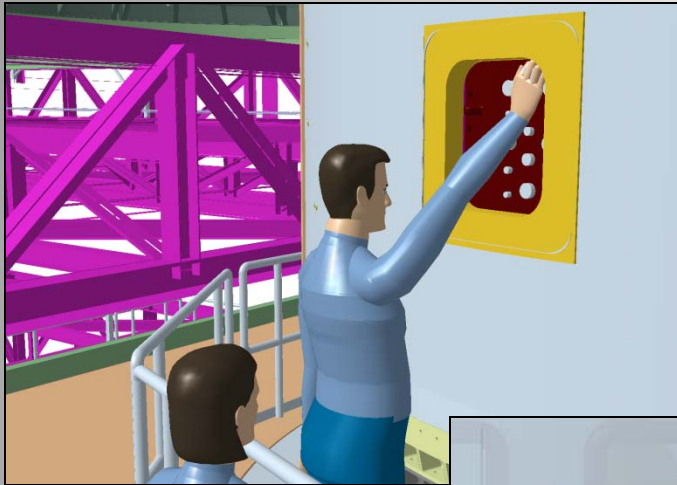
- The 17" x 10" porthole does provide sufficient clearance to allow possible two-handed operations.
- Reduction in porthole size makes capability for two-handed access and operations more cumbersome.



Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



ANALYSIS DESCRIPTION (16" x 14" / 3" Corner Radii)



REASONING

- Clearance size was generated from the Ares I US FS ICD 18" x 16" dimension and reducing both the height and width by 2".

INITIAL PERCEPTION

- *Provides access to all connectors and top of electrical panel*
- *Provides visual access*



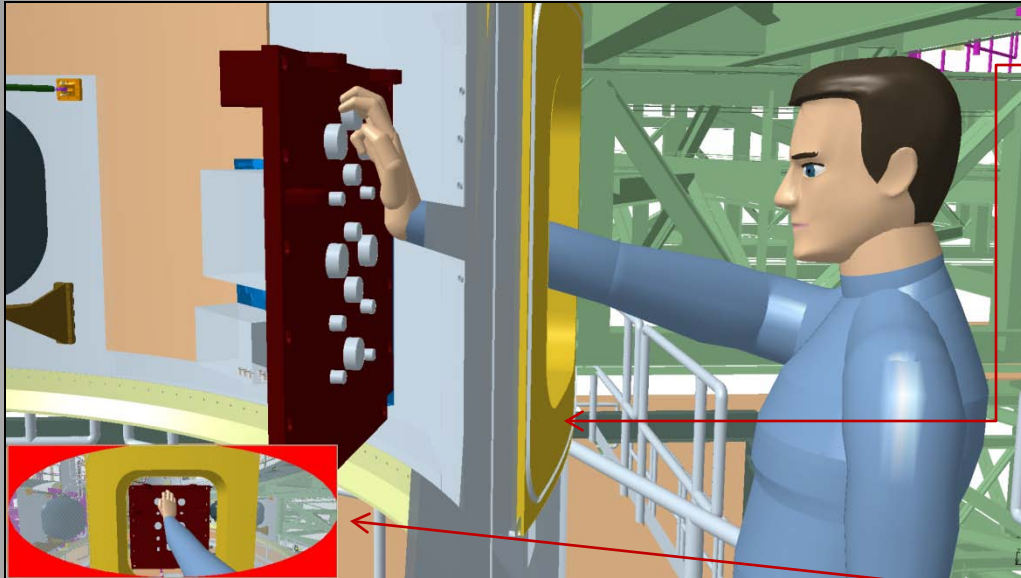
Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



ANALYSIS DESCRIPTION (16" x 14" / 3" Corner Radii)

JACOBS

95thtile American Male



- The 16" x 14" opening allows physical access to all electrical panel connectors. The 16" x 14" opening also allows sufficient arm room to alter arm positions for access to lower connectors. (~10.2" total width clearance for male)
(~10.66" total width clearance for female)

- The 16" x 14" opening allows a direct line of sight visual access to all electrical panel connectors.

- Physical access and a direct line of sight to support strut attachments is granted.

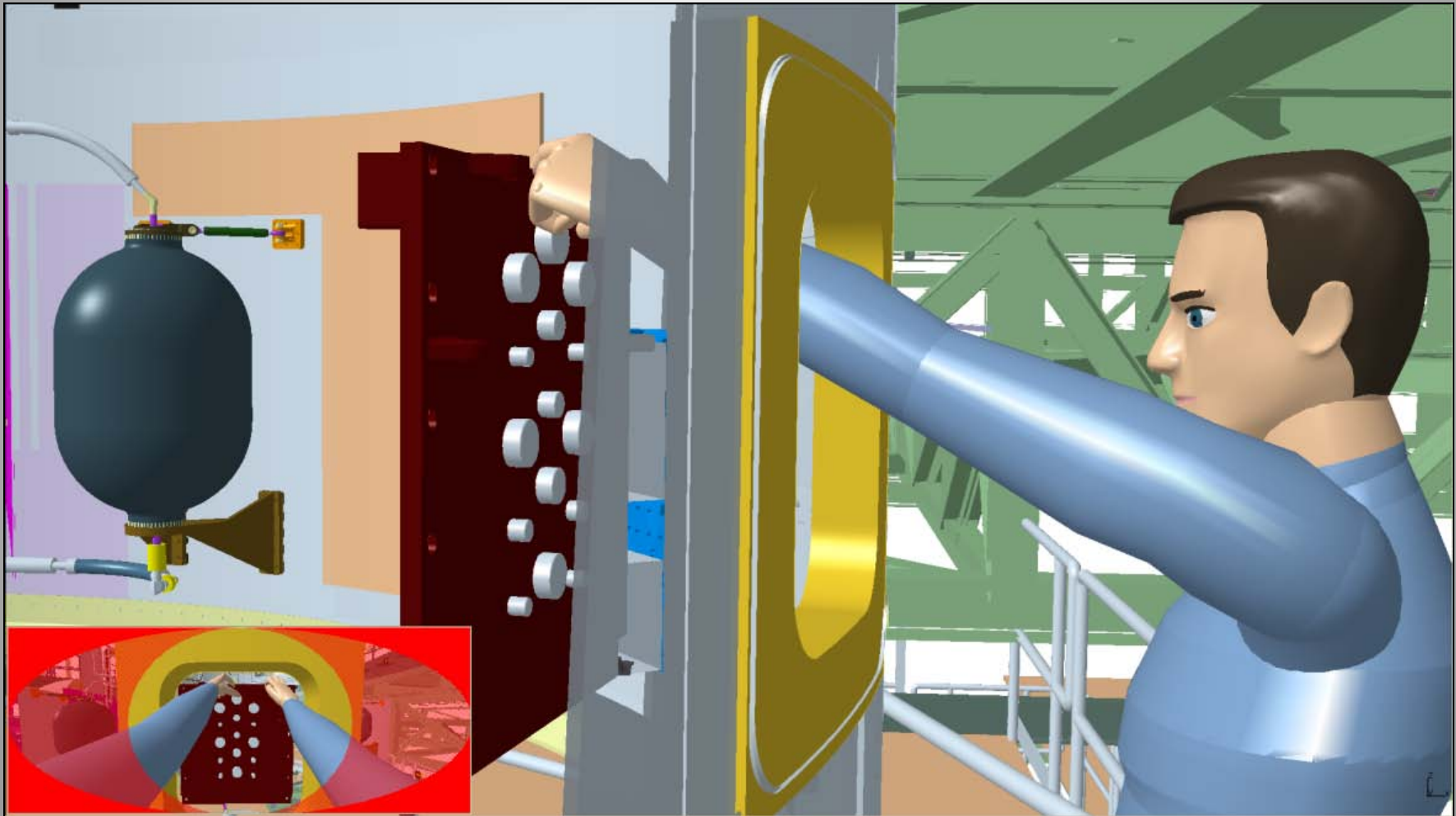


Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



ANALYSIS DESCRIPTION (16" x 14" Diameter Two-Handed Operation)

95thtile American Male



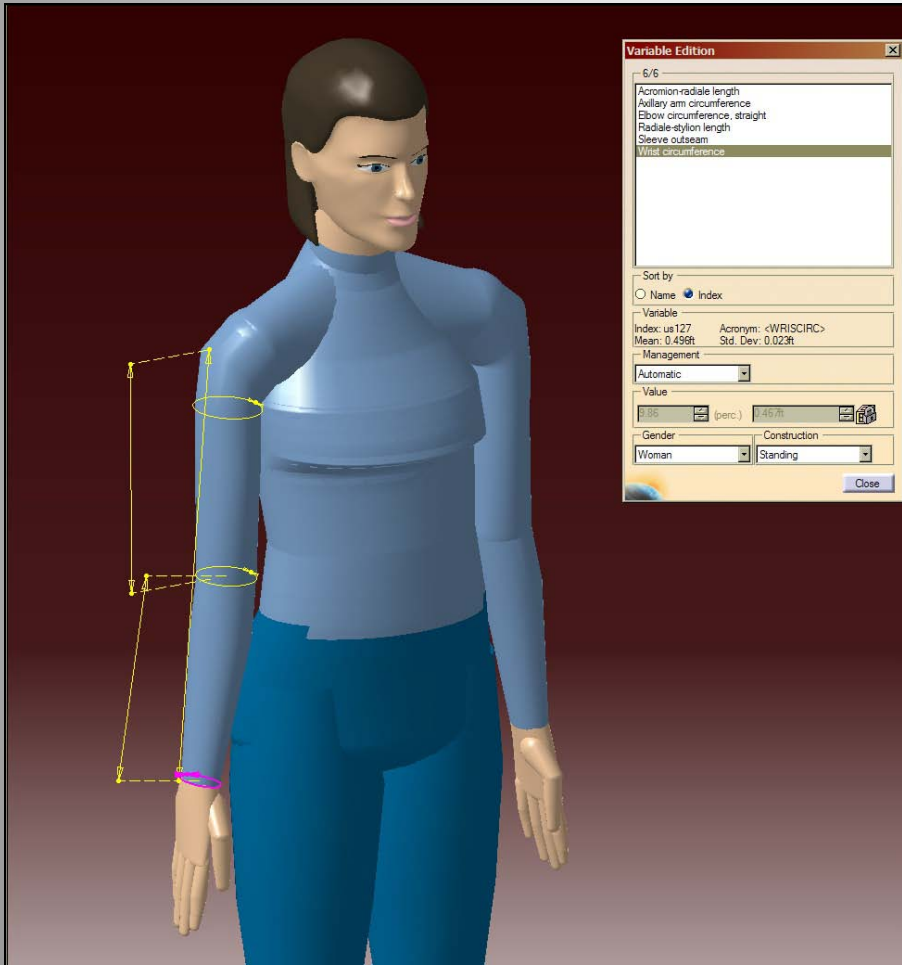
- The 16" x 14" porthole does provide sufficient clearance to allow possible two-handed operations.



Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



ANALYSIS DESCRIPTION (Human Sizing) 5th% tile American Female



Variable Edition

6/6

- Acromion-radiale length
- Axillary arm circumference
- Elbow circumference, straight
- Radiale-stylian length
- Sleeve outseam
- Wrist circumference

Sort by
 Name Index

Variable
Index: us127 Acronym: <WRISCIIRC>
Mean: 0.499ft Std. Dev: 0.023ft

Management
Automatic

Value
0.467 (perc.) 0.467ft

Gender: Women Construction: Standing

Close

Acromion-radiale Length = .951 ft (11.41")

Axillary Arm Circumference = .874ft (10.48")

Elbow Circumference, Straight = .723ft (8.78")

Radiale-stylian Length = .742ft (8.90")

Sleeve Outseam = 1.669ft (20.02")

Wrist Circumference = .467ft (5.60")

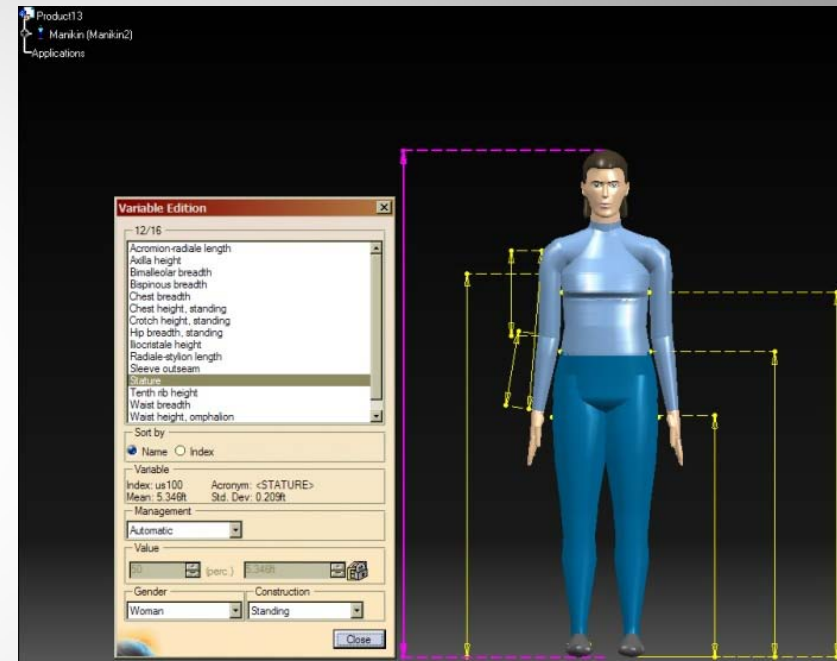
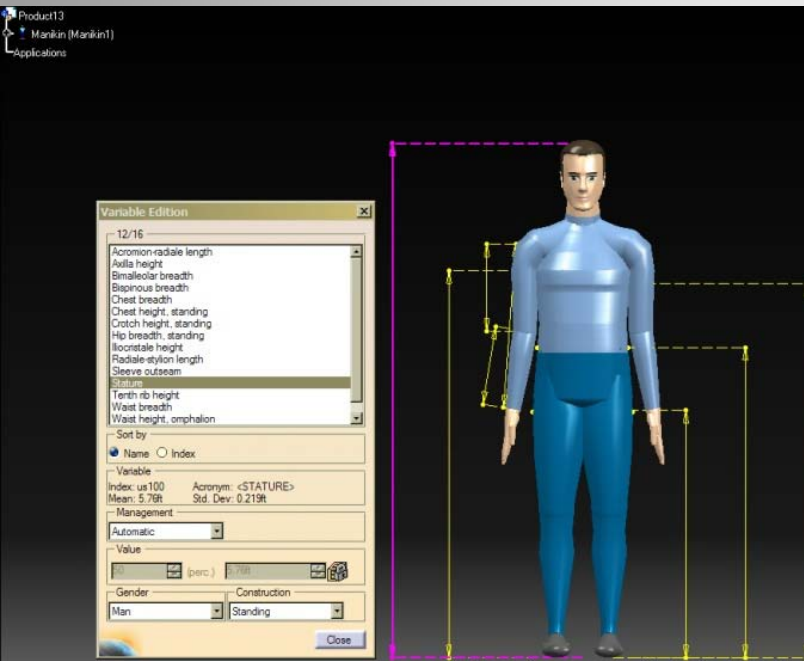
➤ Diameter ~3.34"
[will be used to approximate available clearance]



Modeling and Simulation of the ARES UPPER STAGE Transportation, Lifting, Stacking and Mating operations within the Vehicle Assembly Building at KSC



ANALYSIS DESCRIPTION (Human Sizing)



5%tile	5.4ft (5' 4.8")
10%tile	5.48ft (5' 5.76")
50%tile	5.76ft (5' 9.12")
90%tile	6.041ft (6' .492")
95%tile	6.121ft (6' 1.452")

5%tile	5.003ft (5' .036")
10%tile	5.078ft (5' .936")
50%tile	5.346ft (5' 4.152")
90%tile	5.613ft (5' 7.356")
95%tile	5.689ft (5' 8.268")