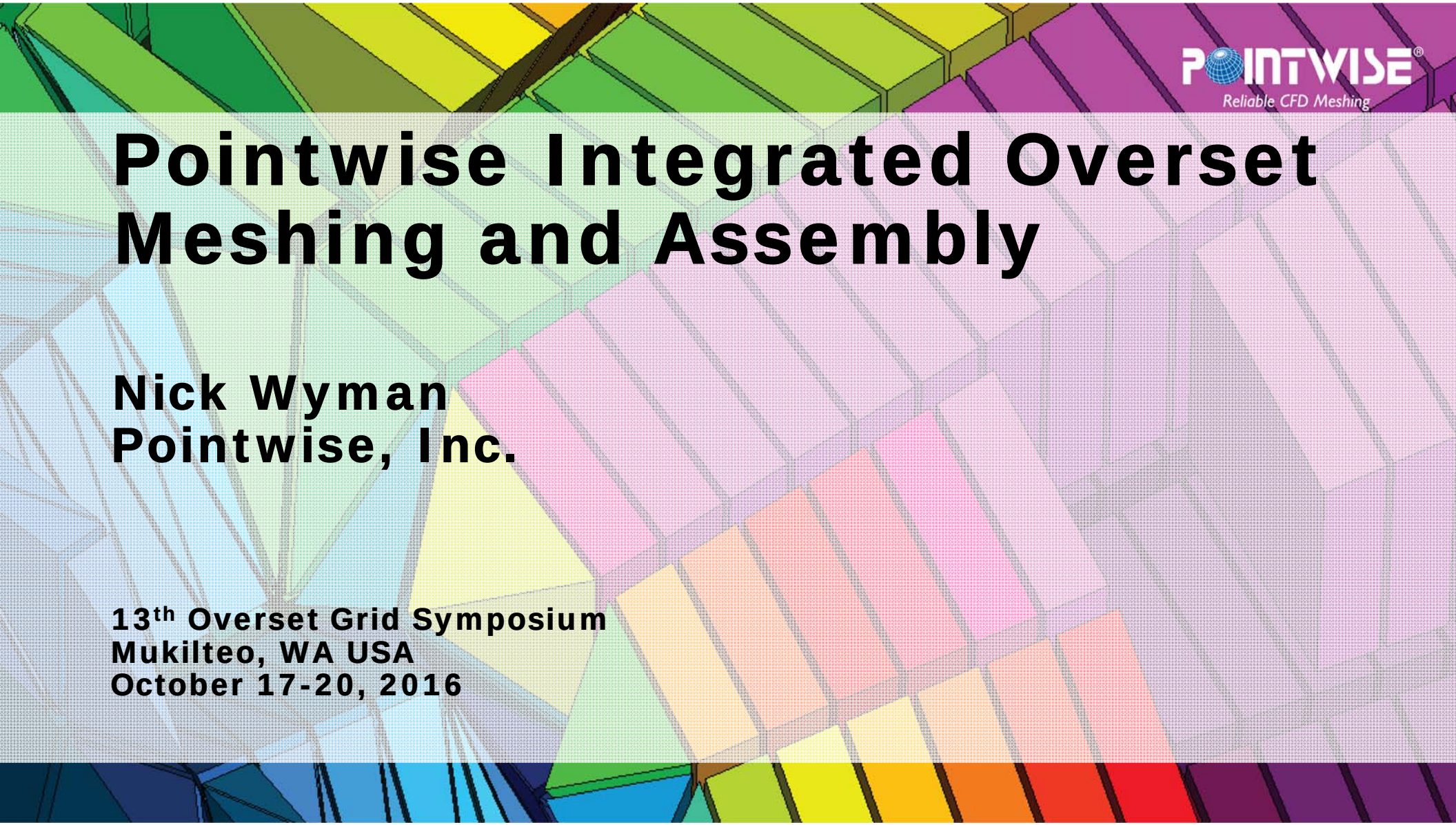

Pointwise Integrated Overset Meshing and Assembly

Nick Wyman
Pointwise, Inc.

13th Overset Grid Symposium
Mukilteo, WA USA
October 17-20, 2016

Motivation

POINTWISE®
Reliable CFD Meshing

- Meshing and complex configuration management remains a bottleneck in the overset CFD workflow
  - Complex configurations consist of many components with discrete relationships
  - Component management currently falls to the modeling and simulation engineer

- Overset meshing and grid assembly tools should work in tandem to achieve an optimal simulation model
  - Meshing tools should match overset paradigm
  - Feedback from the grid assembly process should guide mesh improvement

Hierarchical Body System (Frameworks)

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Reliable CFD Meshing

Framework = Independent system for component geometry and meshing

- Reduced Cognitive Load
  - Isolation simplifies component meshing
  - Active Framework controls entity selection pool
  - Demoted rendering of inactive Frameworks
  - Local coordinate system – natural data input

- Configuration Management
  - Hierarchical Framework Transformation
    - Transforms inherit from parent
  - Attachment Points – natural definition of Framework Transform
  - Framework Instancing - facilitates repetitive geometry

Hierarchical Body System

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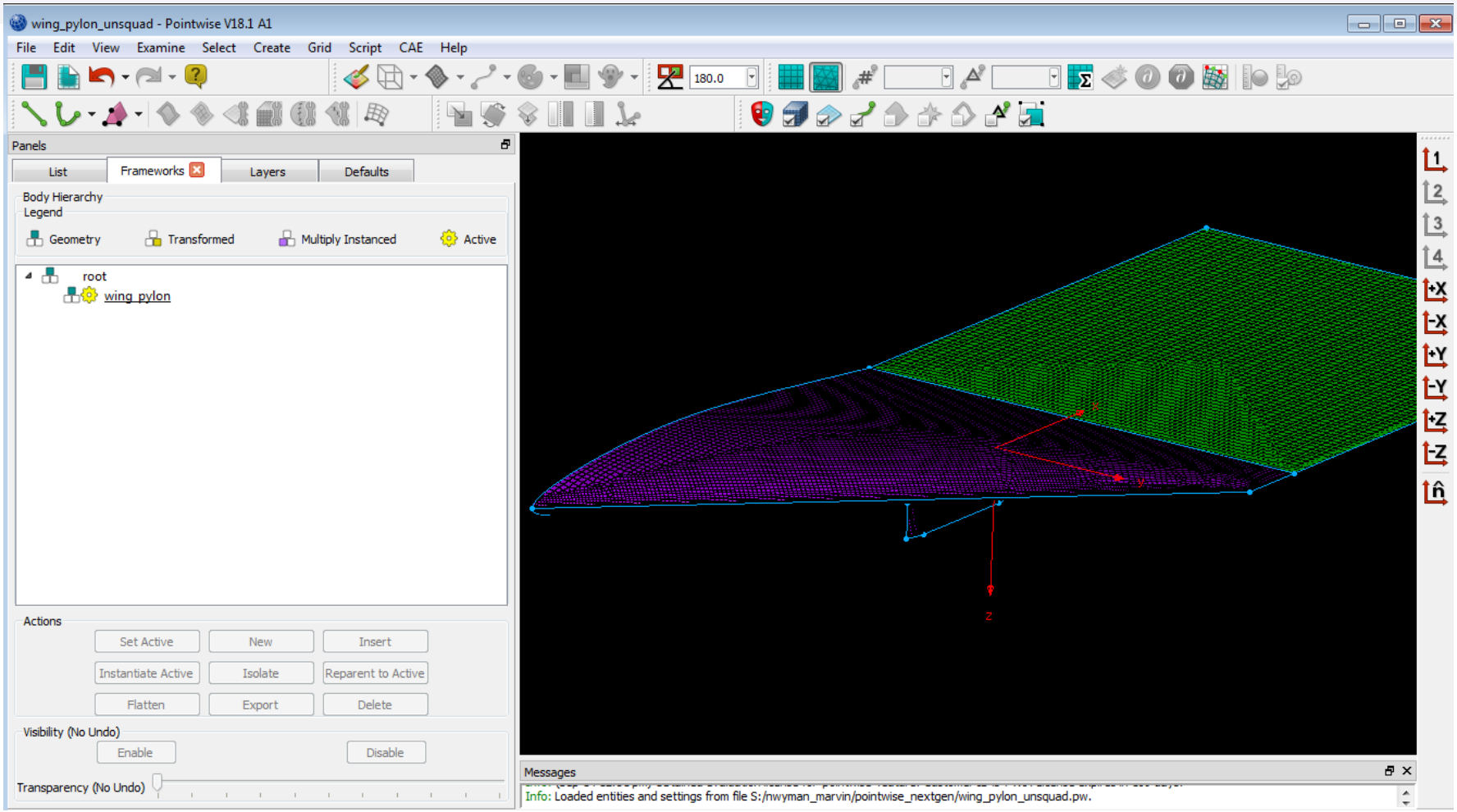
Reliable CFD Meshing



Hierarchical Body System

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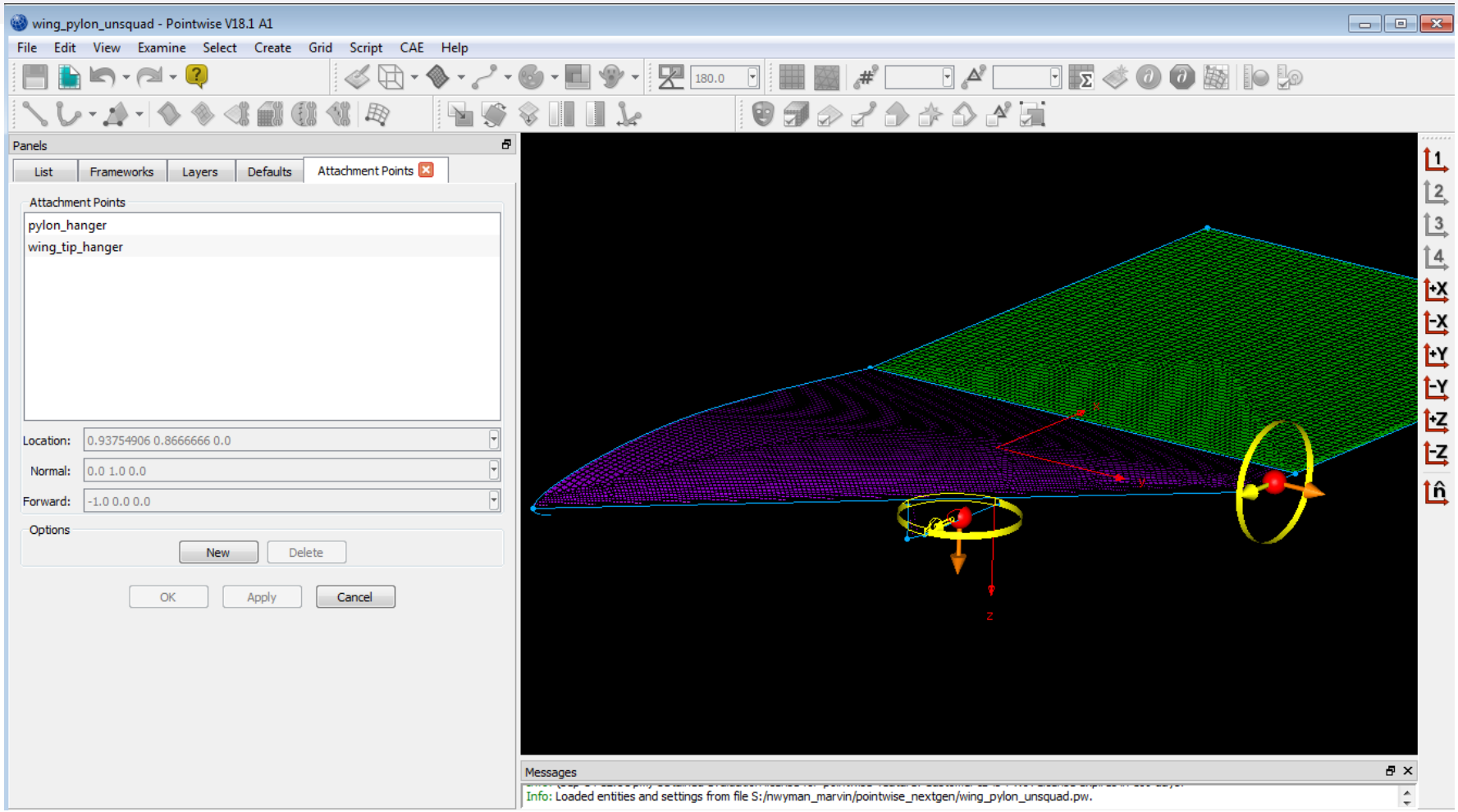

Hierarchical Body System

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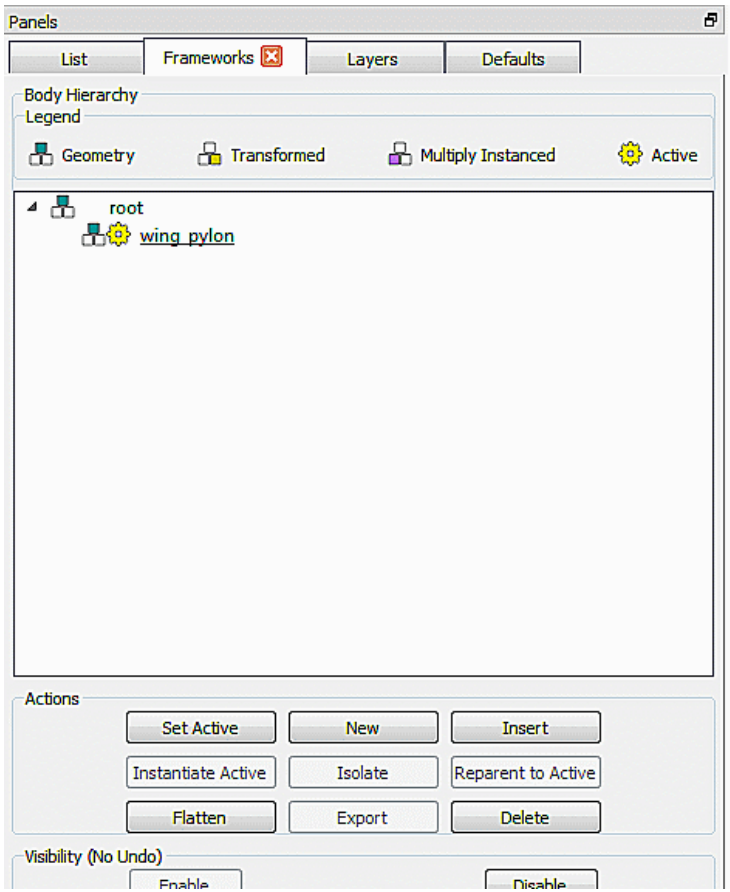
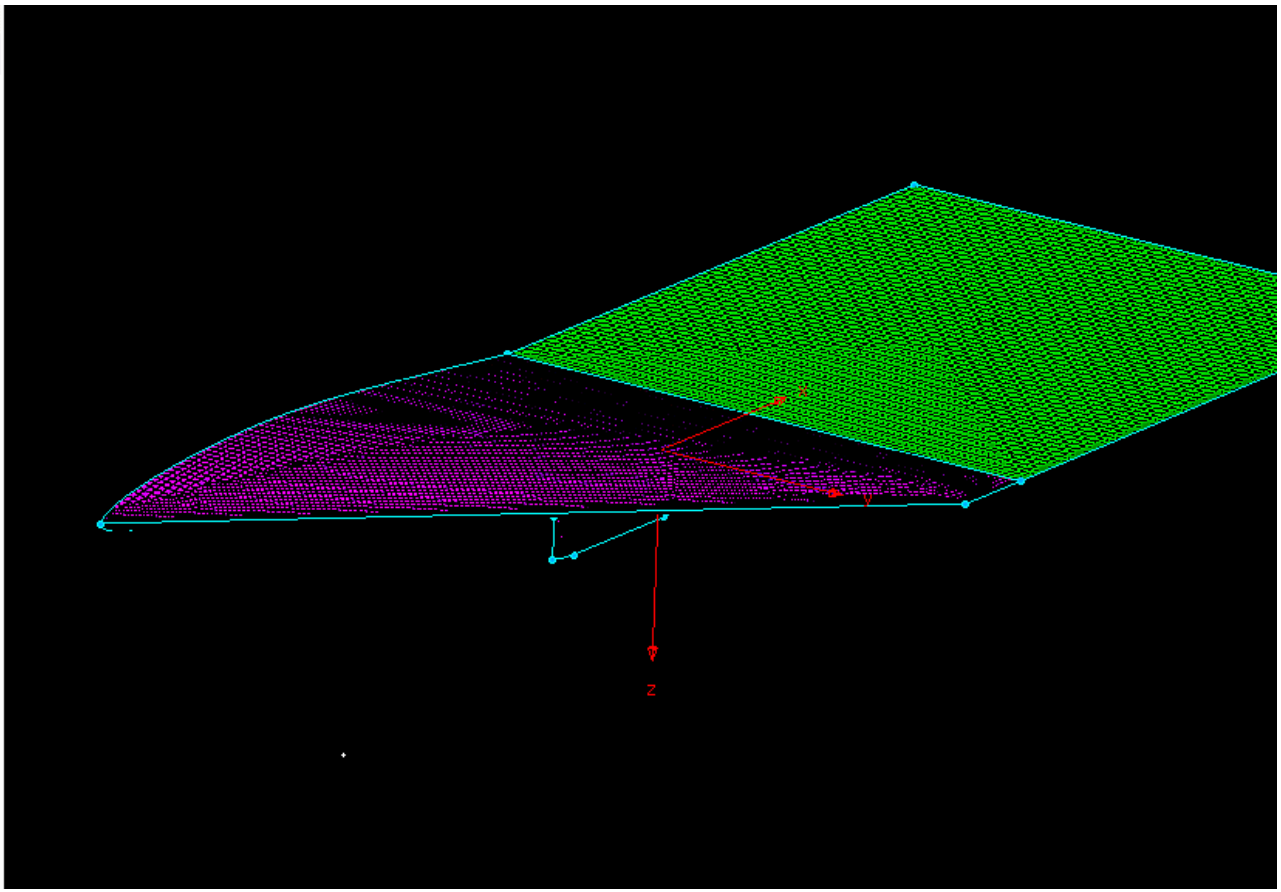
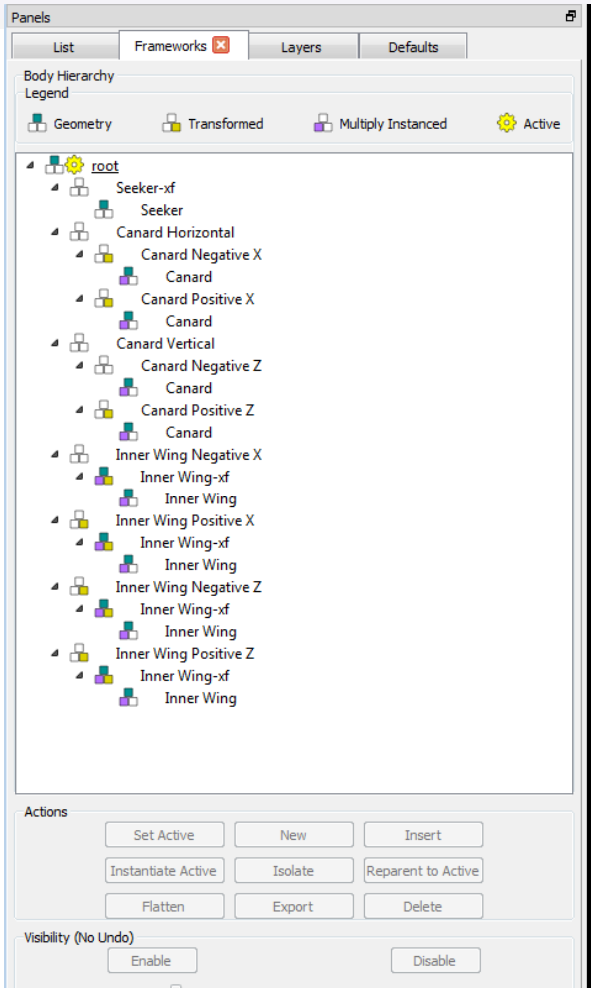
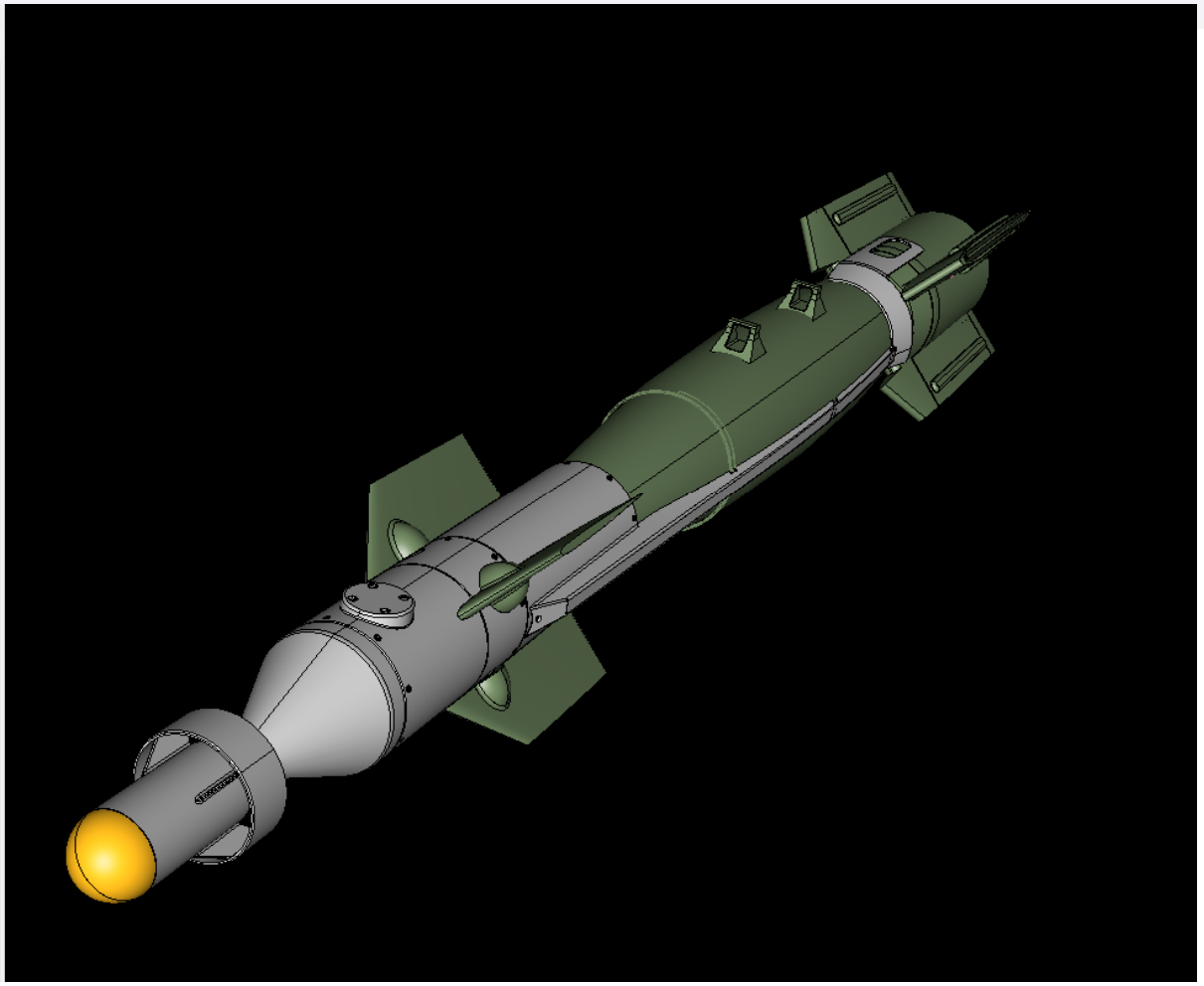




Hierarchical Body System





Panels

List | Frameworks | Layers | Defaults

Body Hierarchy

Legend

Geometry Transformed Multiply Instanced Active

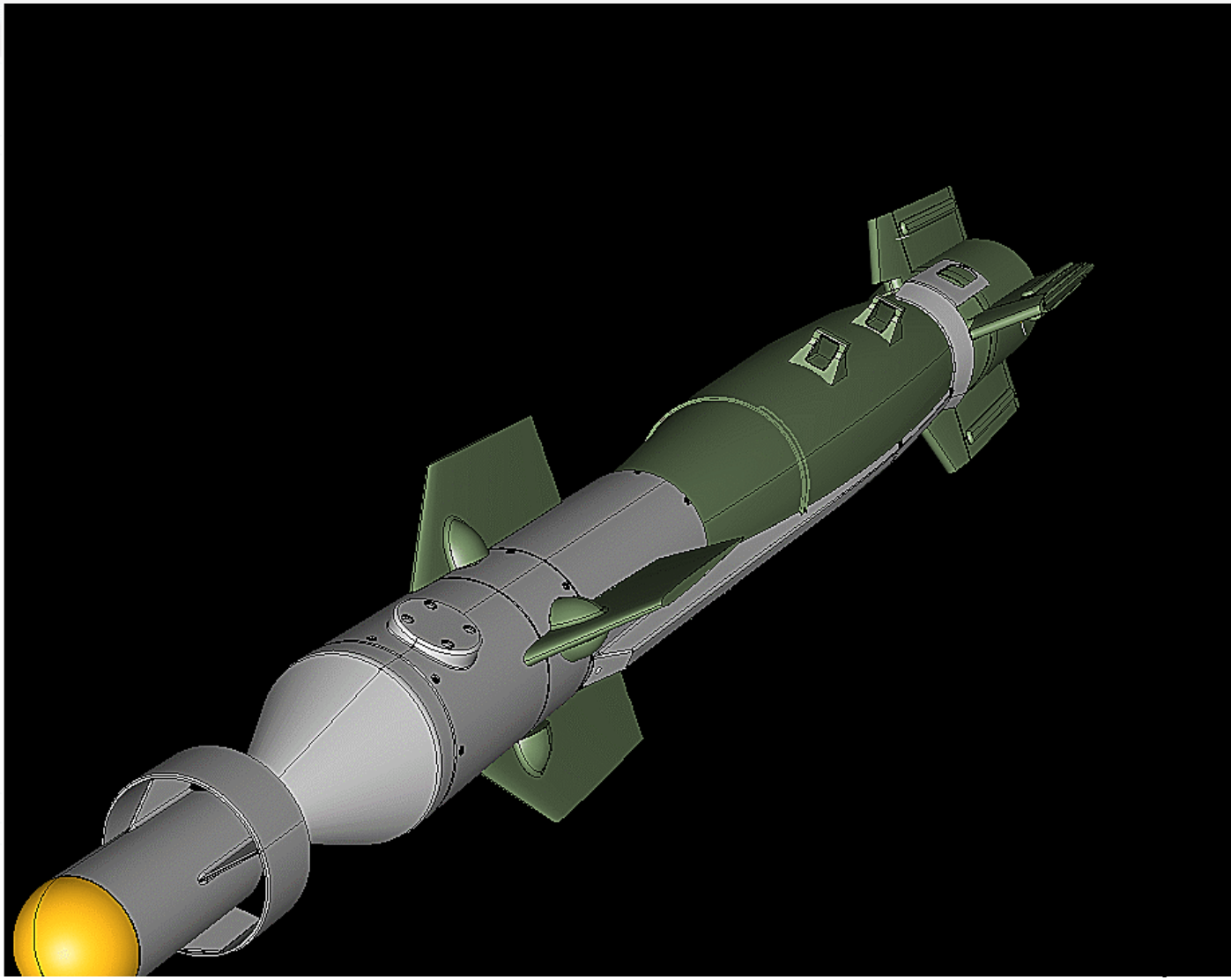
- root
  - Seeker-xf
    - Seeker
  - Canard Horizontal
    - Canard Negative X
      - Canard
    - Canard Positive X
      - Canard
  - Canard Vertical
    - Canard Negative Z
      - Canard
    - Canard Positive Z
      - Canard
  - Inner Wing Negative X
    - Inner Wing-xf
      - Inner Wing
  - Inner Wing Positive X
    - Inner Wing-xf
      - Inner Wing
  - Inner Wing Negative Z
    - Inner Wing-xf
      - Inner Wing
  - Inner Wing Positive Z
    - Inner Wing-xf
      - Inner Wing

Actions

Set Active	New	Insert
Instantiate Active	Isolate	Reparent to Active
Flatten	Export	Delete

Visibility (No Undo)

Enable Disable



Hierarchical Body System

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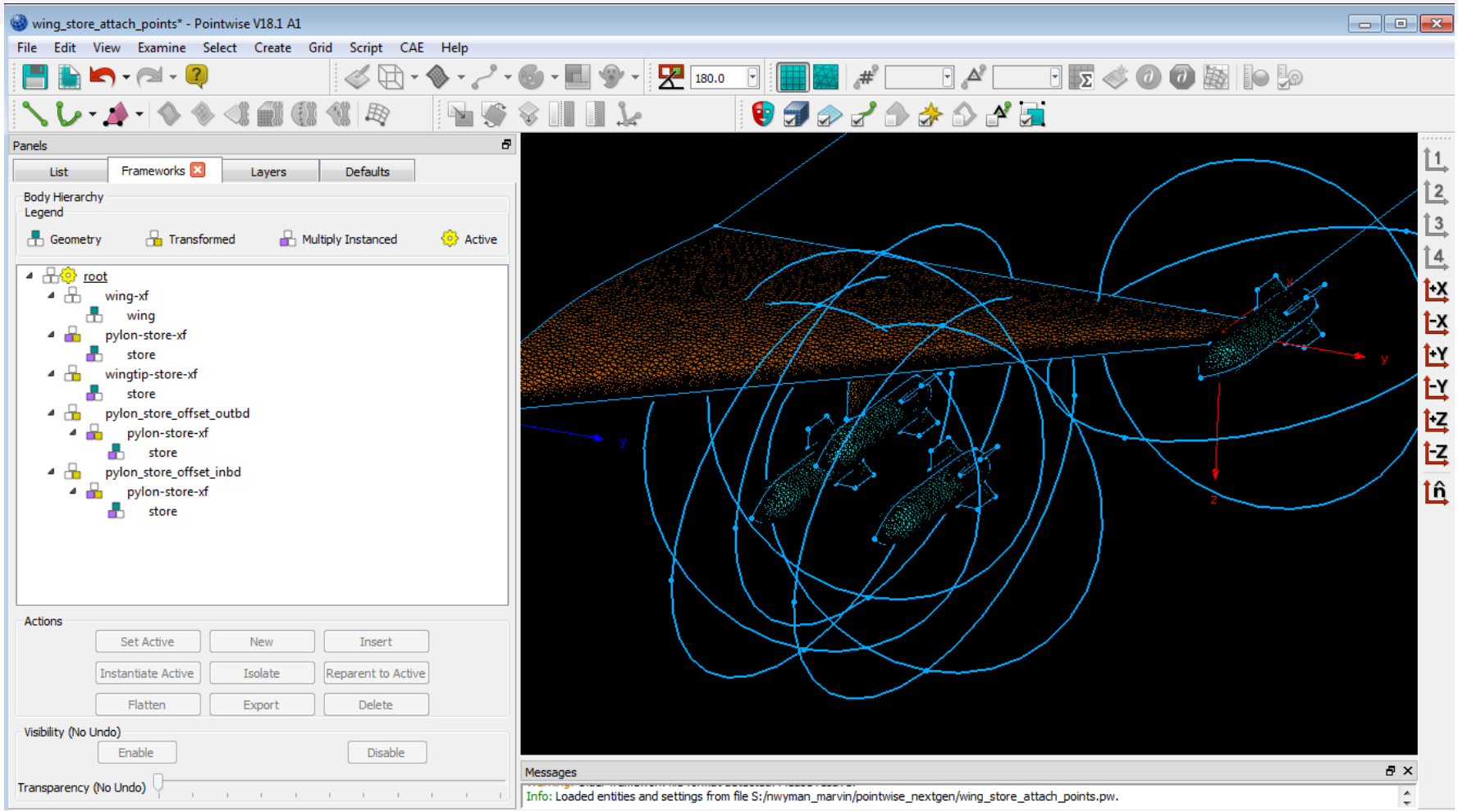

Automated Near-Body Meshing

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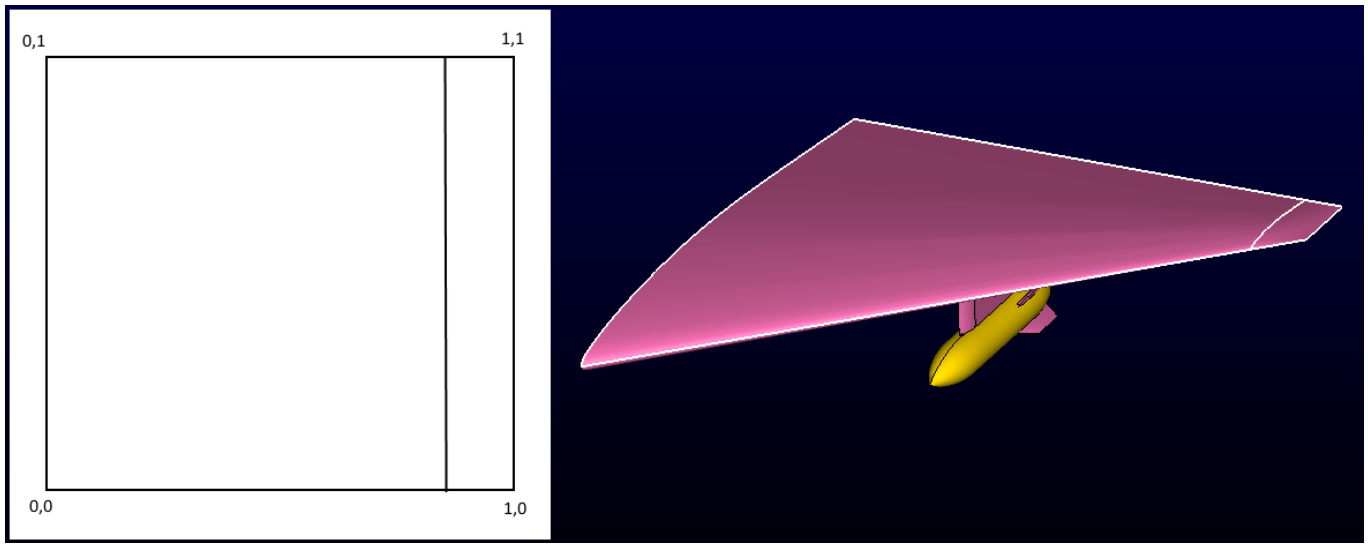
Reliable CFD Meshing

- Boundary layer mesh by highly automated anisotropic tri and quad extrusion
- Parametric meshing on CAD quilt topology



Automated Off-Body Meshing

POINTWISE®
Reliable CFD Meshing

- Sketch-based tool for block shape definition
  - Enclosing mode “wraps” target entities
  - Automatic sizing and alignment

- Voxel meshing
  - Hierarchical recursive meshing to target length scale
  - Highly automated, fast
  - Control over layer buffers
  - Interface between layers is face-face

Automated Off-Body Meshing

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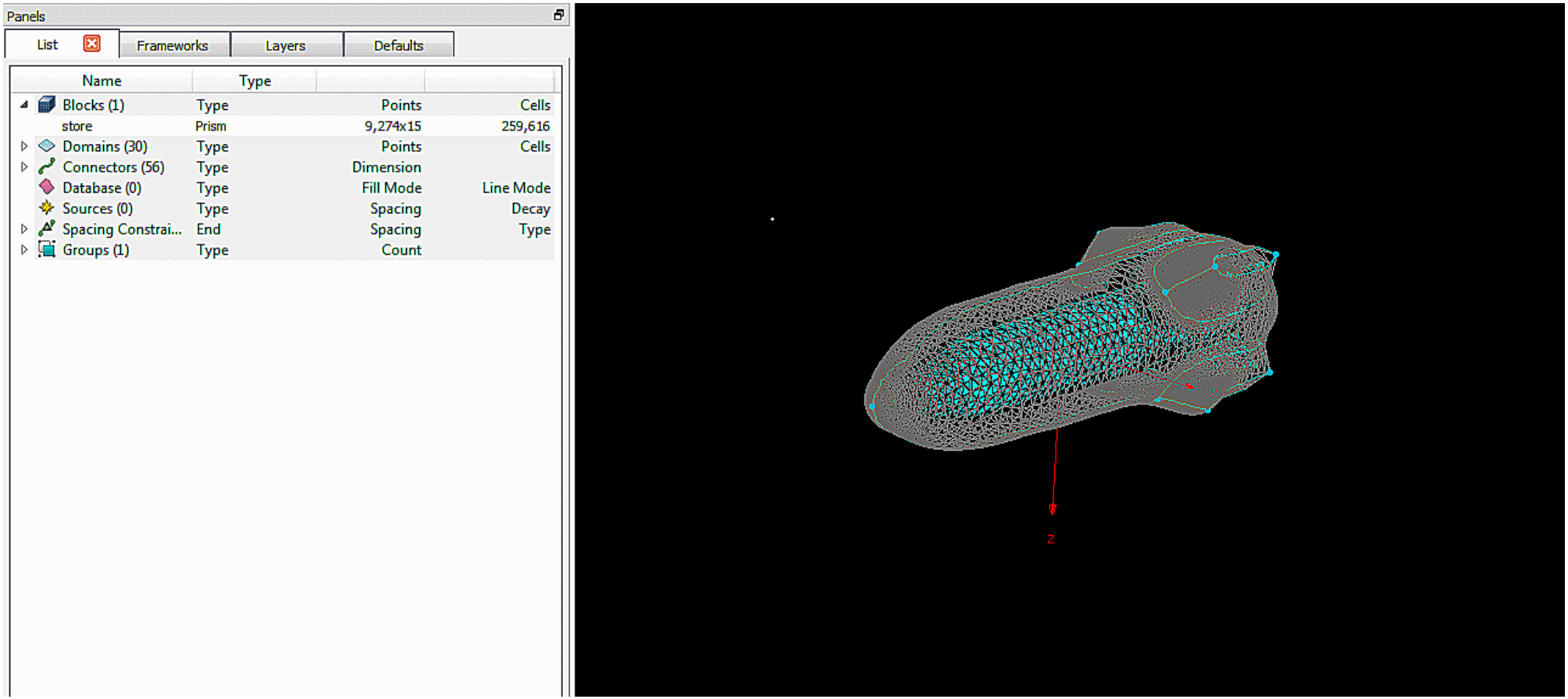
Reliable CFD Meshing



Automated Off-Body Meshing

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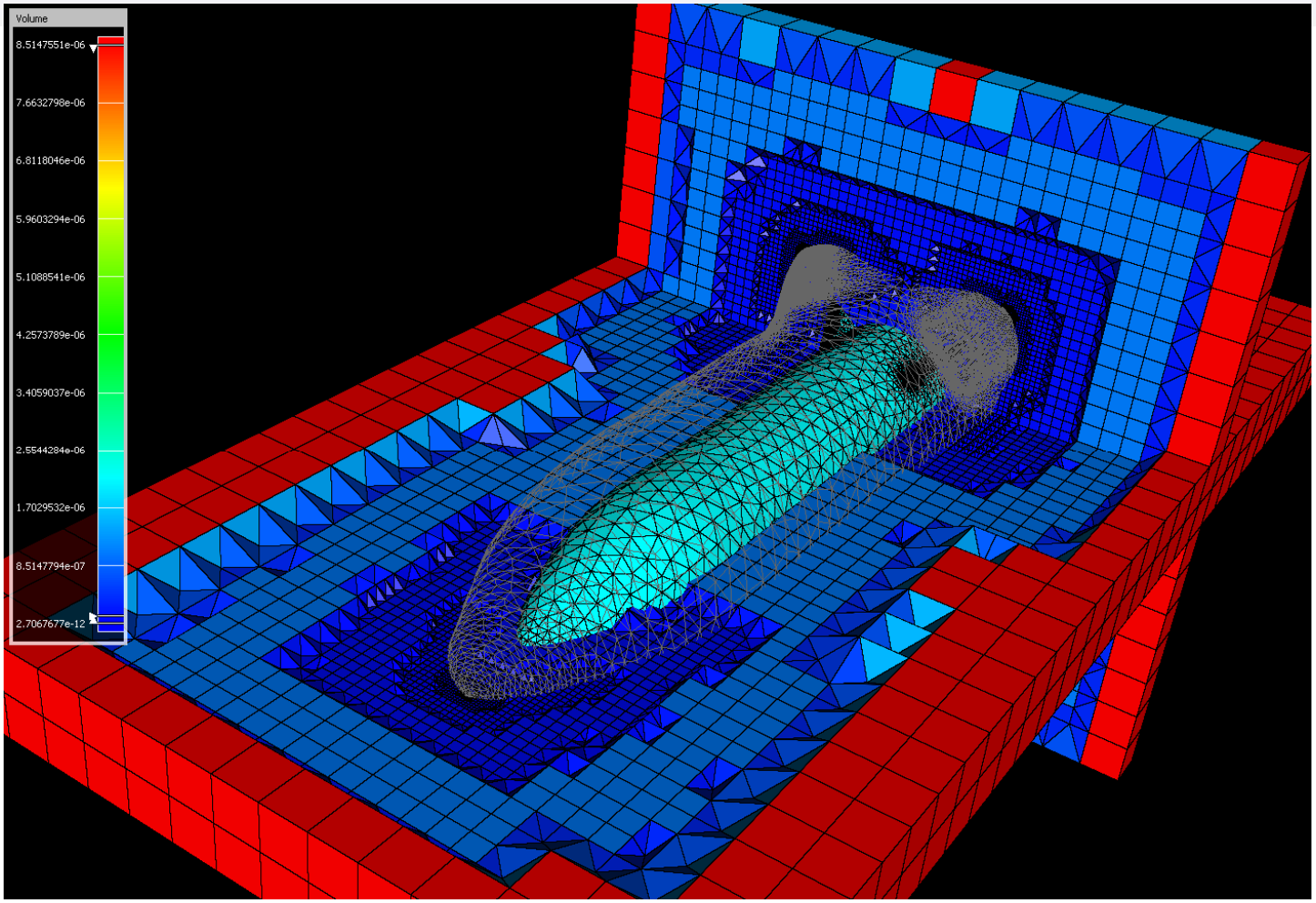
Reliable CFD Meshing



Automated Off-Body Meshing

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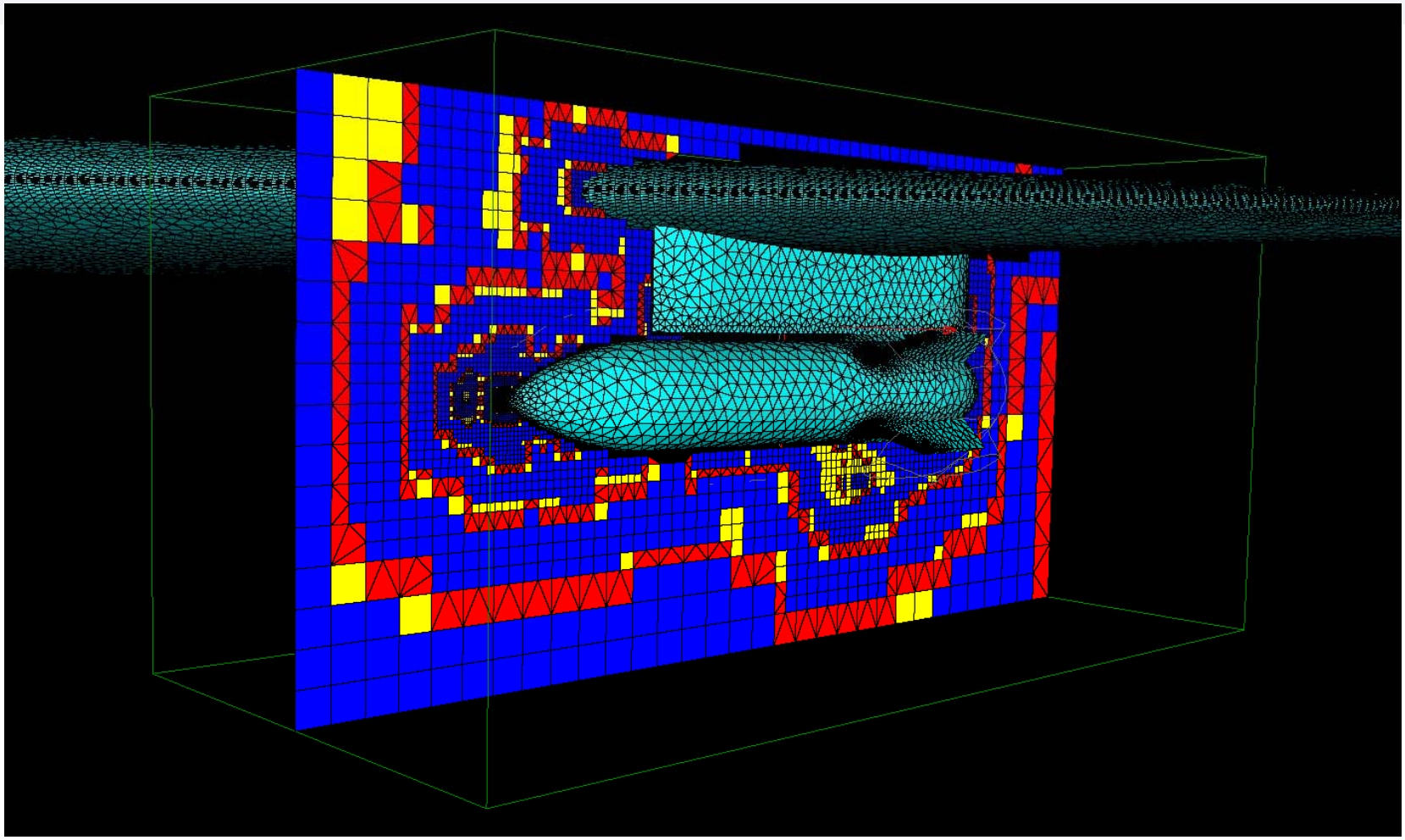
Reliable CFD Meshing

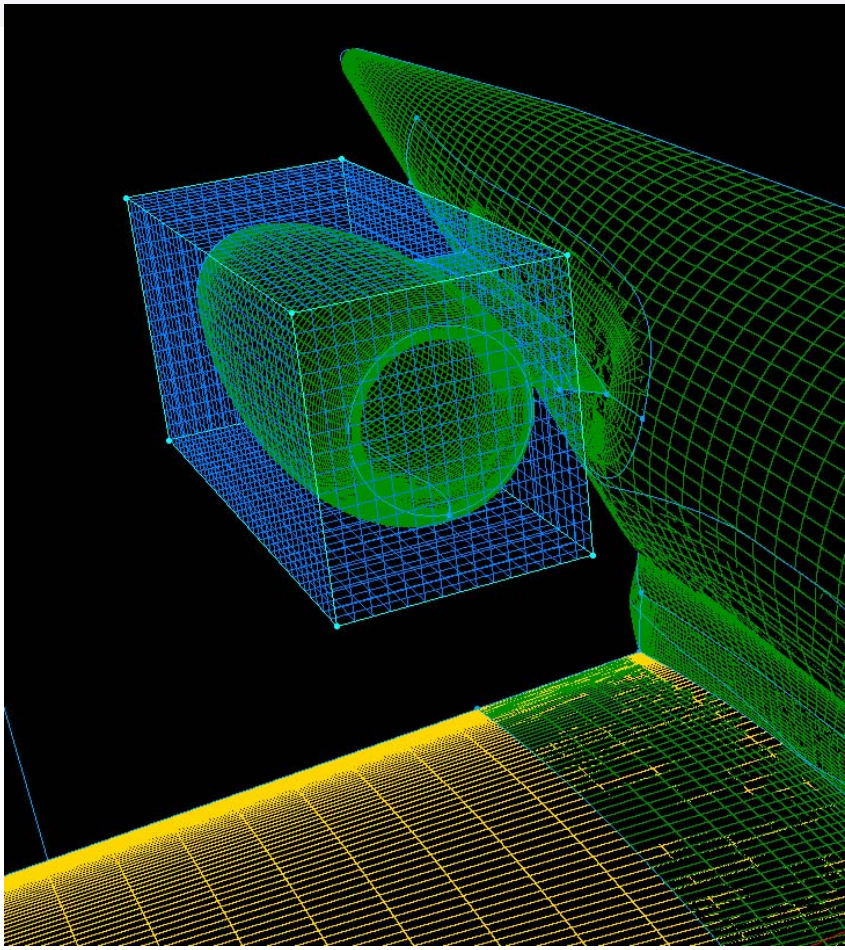


Overset Mesh Remediation Tools

POINTWISE®
Reliable CFD Meshing

- Refinement Grids
  - Sketch-based definition of structured block enclosing selected entities
  - Block dimension defined by enclosed entities

- Extension of Structured and Unstructured Block adaptation to boundaries



Overset Mesh Remediation Tools

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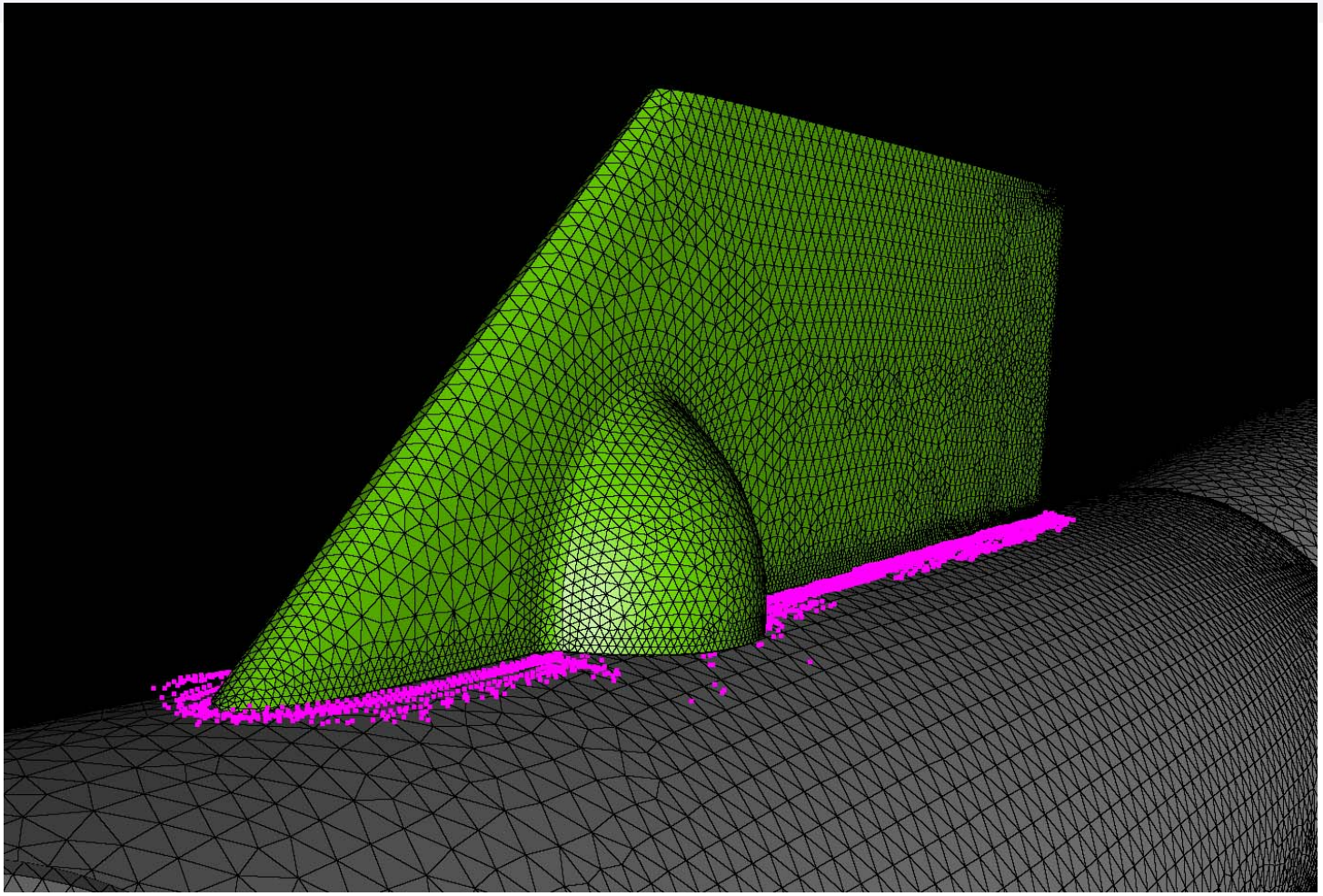
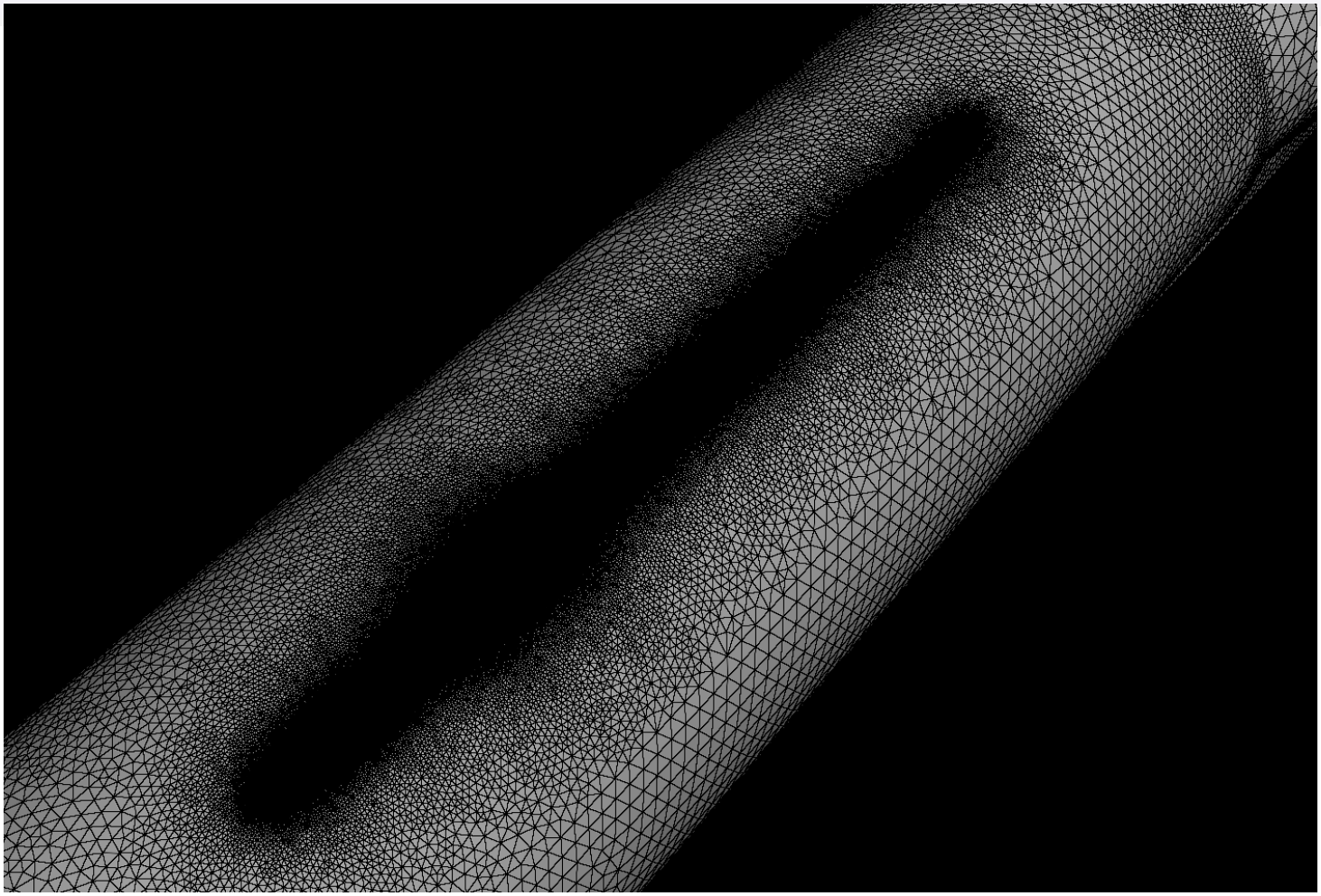
Reliable CFD Meshing



Overset Mesh Remediation Tools

POINTWISE®
Reliable CFD Meshing



Overset Mesh Remediation Tools

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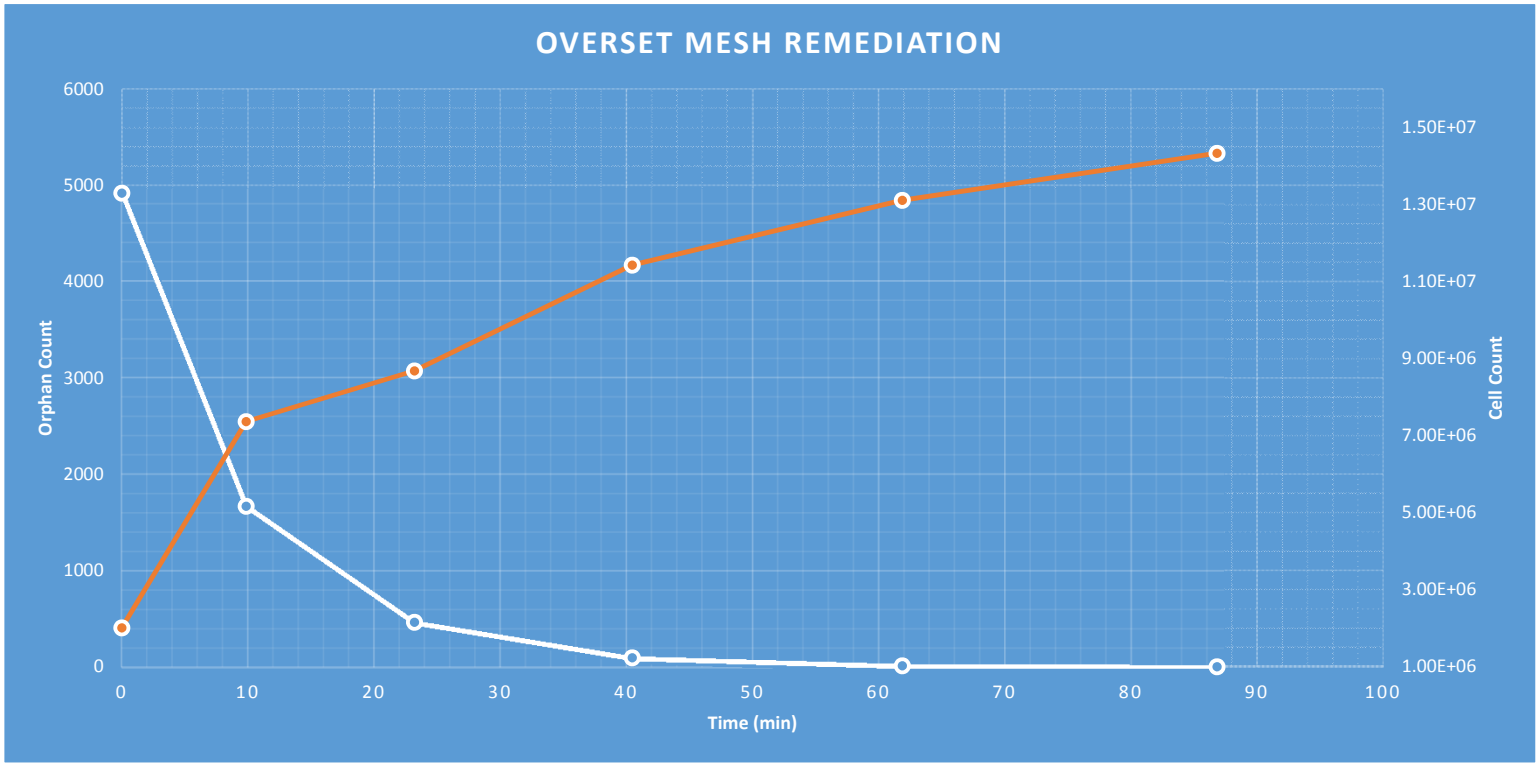
Reliable CFD Meshing

- Automatic orphan remediation
  - Complete orphan removal in 5 cycles
  - < 1.5 hours



Conclusion

POINTWISE®
Reliable CFD Meshing

- Frameworks
  - Improved user experience
  - Natural configuration management
- Automated Near-Body and Off-Body Meshing
- Automated Overset Mesh Remediation
  - Maximize user efficiency
- Acknowledgement
  - This work supported by Arnold Engineering Development Complex, Air Force Materiel Command and the USAF