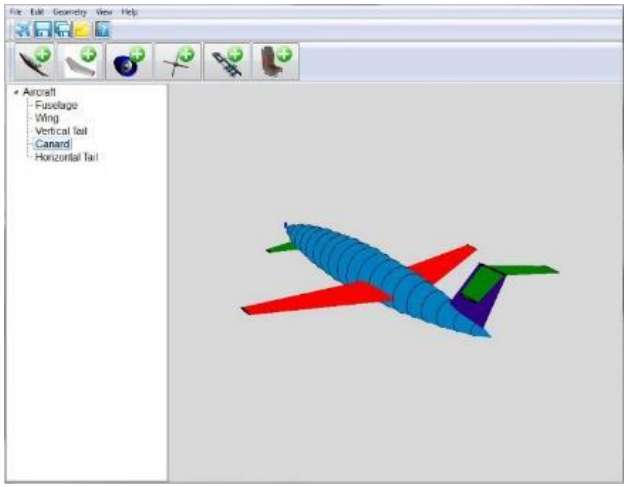
CEAS Technical Committee Aircraft Design (TCAD)
Research Section (SCAD)
October 12-14, 2015
Naples, Italy

Smart Aircraft Modeler (SAM) for Aircraft Conceptual Design



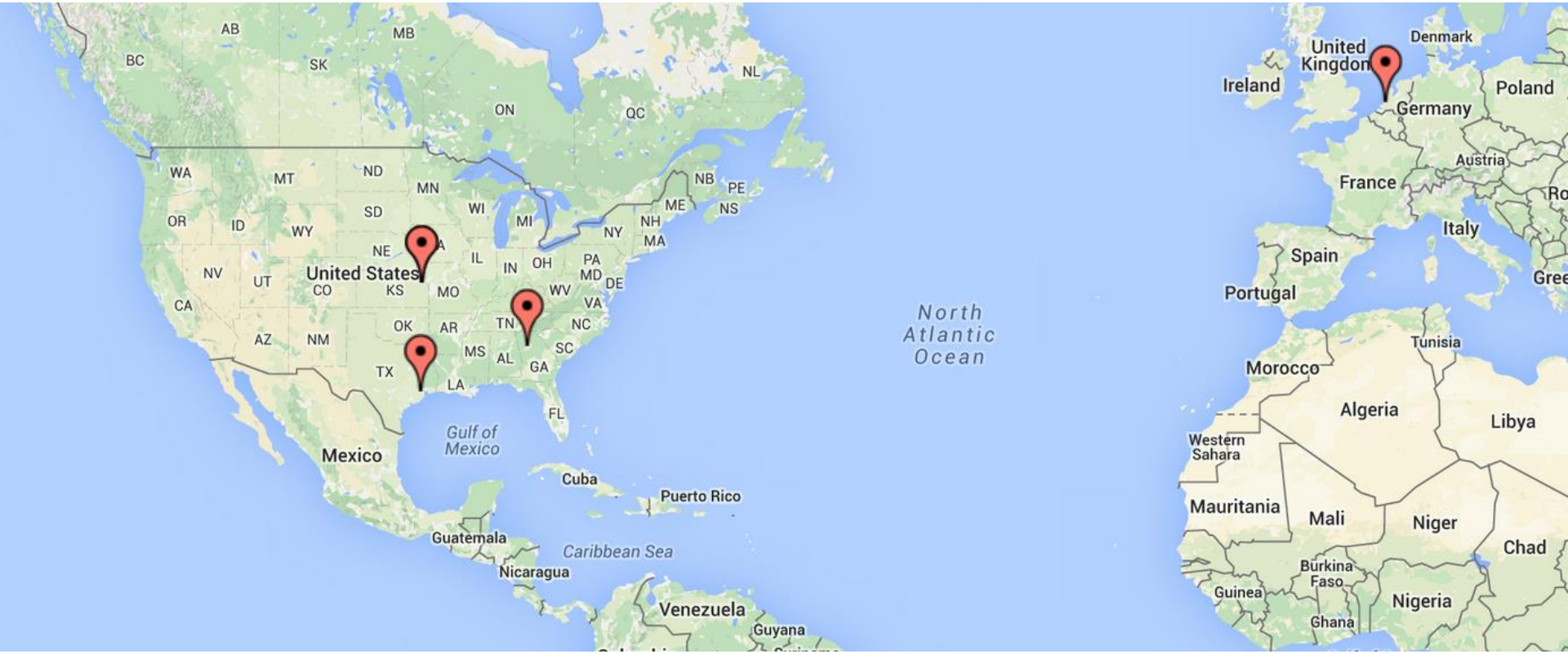
Dr. Willem A.J. Anemaat
anemaat@darcorp.com
Design, Analysis and Research Corporation

- Formed in 1991 by Dr. Jan Roskam and Dr. Willem Anemaat
- Located in Lawrence, Kansas, USA
- Mission:

Provide Integrated Aircraft Design, Development and Consulting Services

  - Market, Support and Develop Airplane Design and Analysis Software
  - Airplane Analysis and Design Engineering Consulting Services
  - Market and Distribute Airplane Design Books Written by Dr. Jan Roskam
  - Wind Turbine Design (Aerodynamics & Structures)

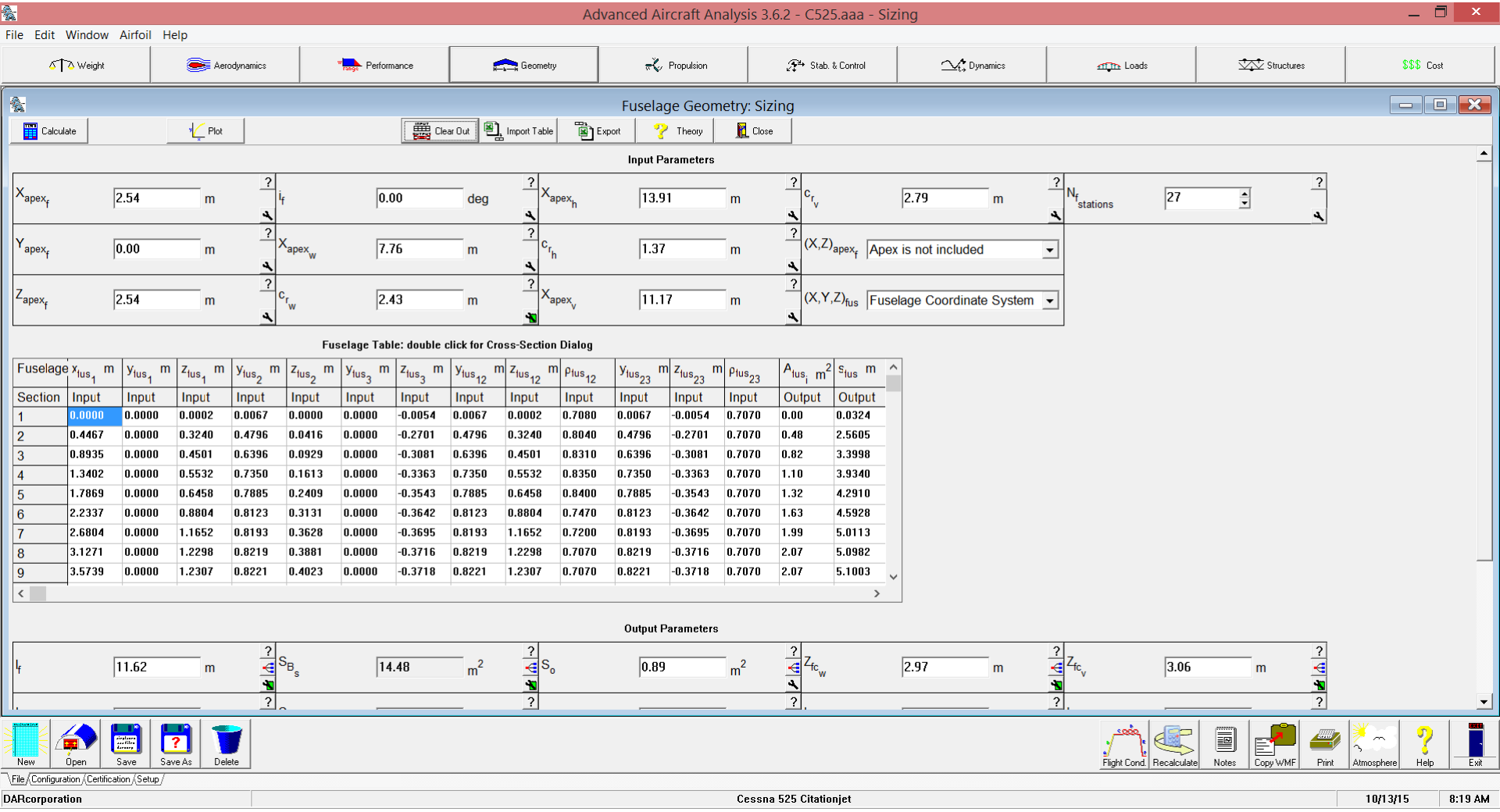
- Headquartered in Lawrence, Kansas
- Branches in Atlanta, Georgia and Houston, Texas
- Coming Soon: The Netherlands



First Flights

SAM: Smart Aircraft Modeler

- 3-D Parametric Modeling Environment
- Inboard Profile
- Subsystems Layout
- ACL: Aircraft and Component Library
  - 3-D Models
  - Database of Specifications


Advanced Aircraft Analysis 3.6.2 - C525.aaa - Sizing
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Aerodynamics
Performance
Geometry
Propulsion
Stab. & Control
Dynamics
Loads
Structures
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Fuselage Geometry: Sizing
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crv 2.79 m
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Yapexf 0.00 m
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crh 1.37 m
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Zapexf 2.54 m
crw 2.43 m
Xapexv 11.17 m
(X,Y,Z)fus Fuselage Coordinate System
Fuselage Table: double click for Cross-Section Dialog
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3 0.8935 0.0000 0.4501 0.6396 0.0929 0.0000 -0.3081 0.6396 0.4501 0.8310 0.6396 -0.3081 0.7070 0.82 3.3998
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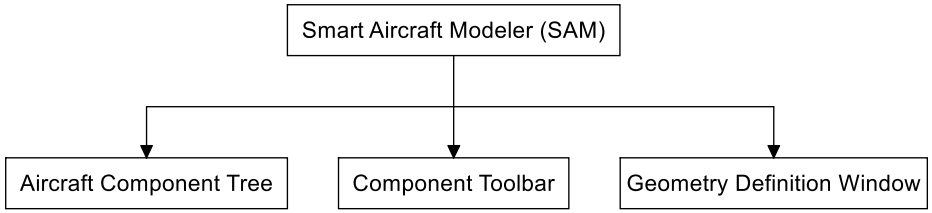
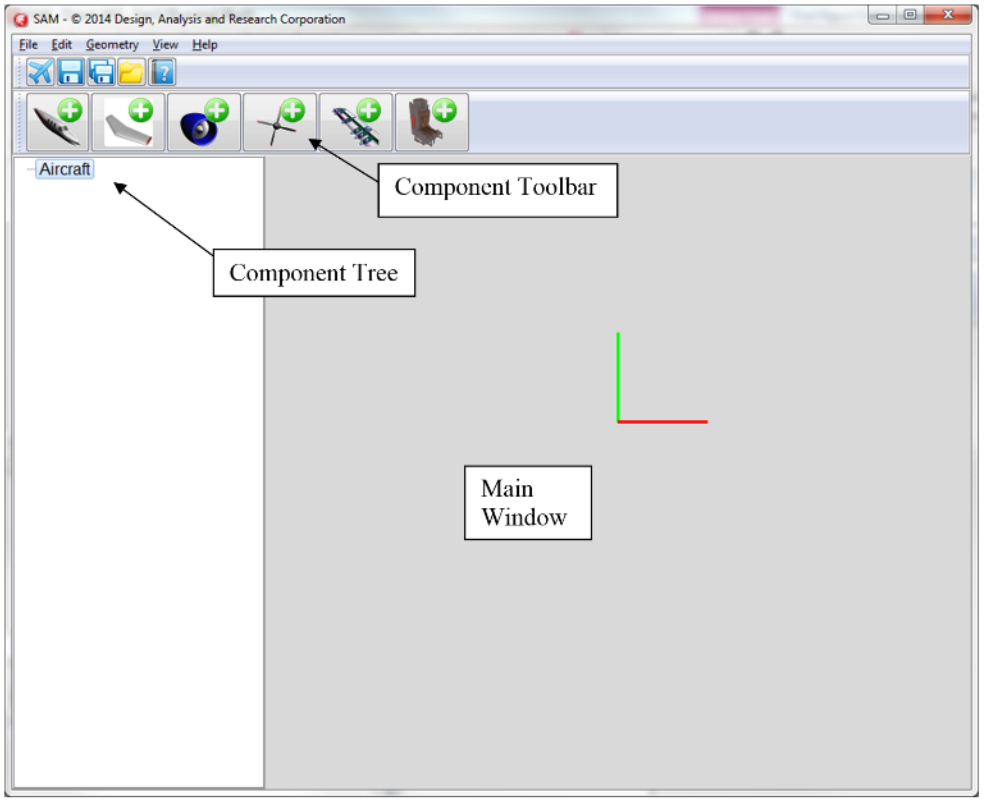
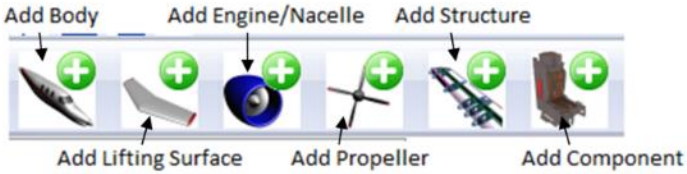
SAM Layout and GUI

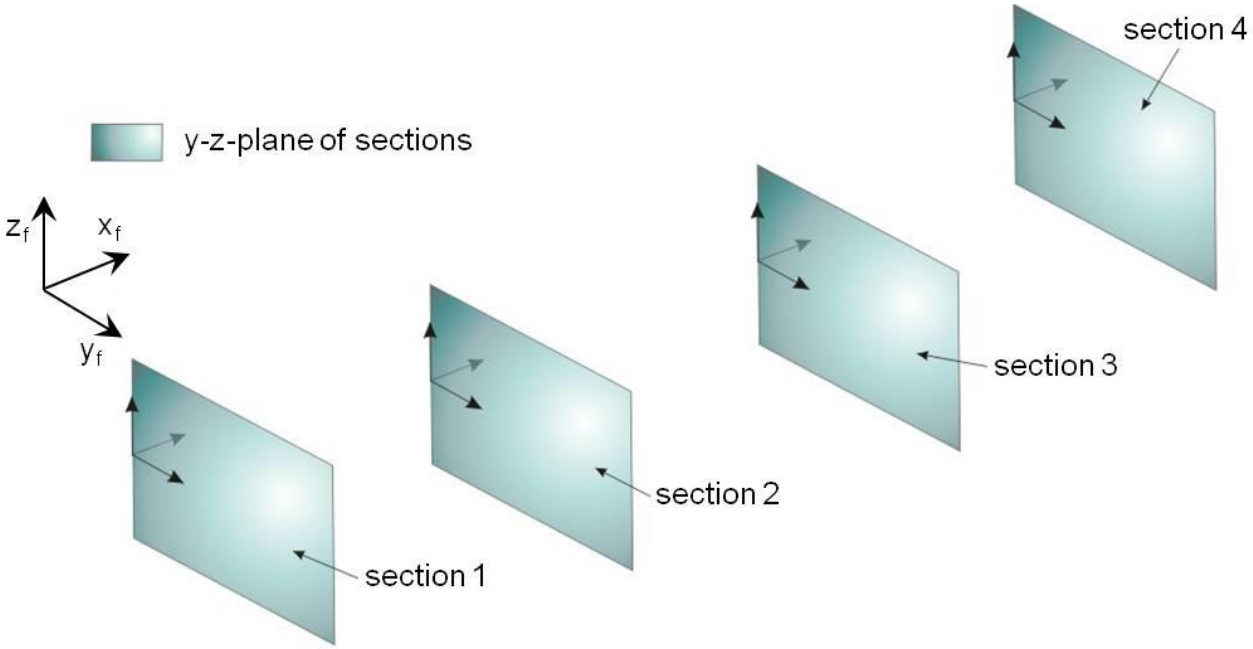






Enhanced 3-D Geometry Module

Format: Common Aircraft Configuration Schema (CPACS)



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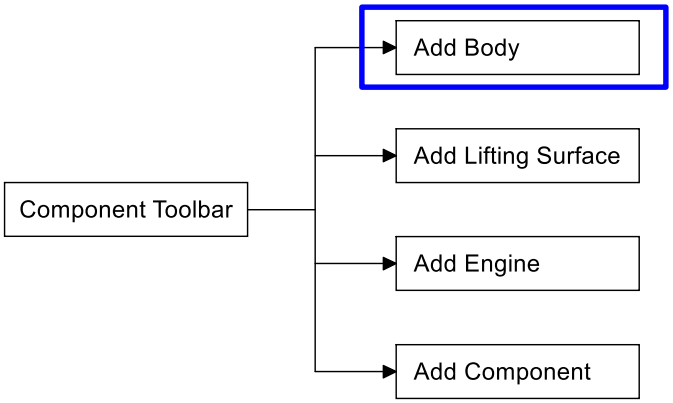
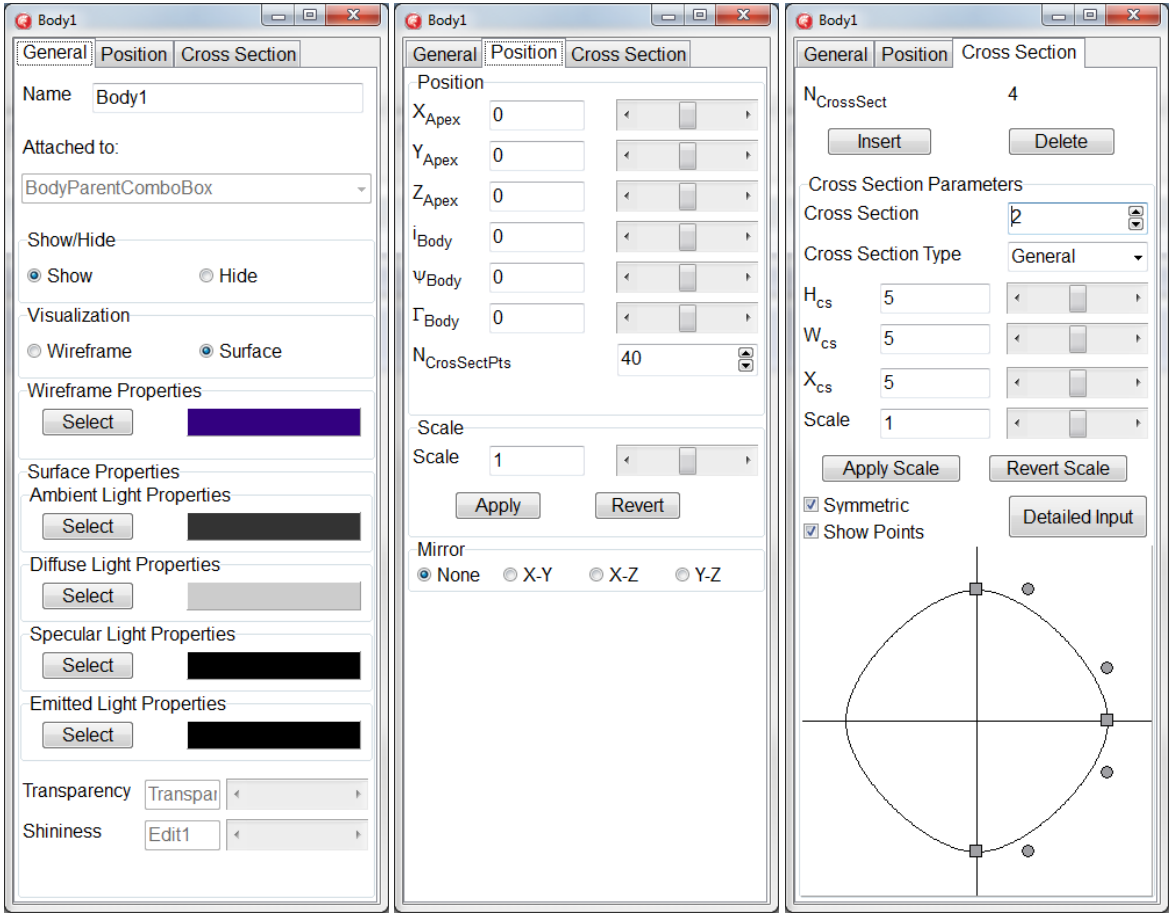
    - name
    - description
    - transformation
    - elements
      - element
        - uID
        - name
        - description
        - airfoilUID
        - transformation
  - section
  - section
  - section

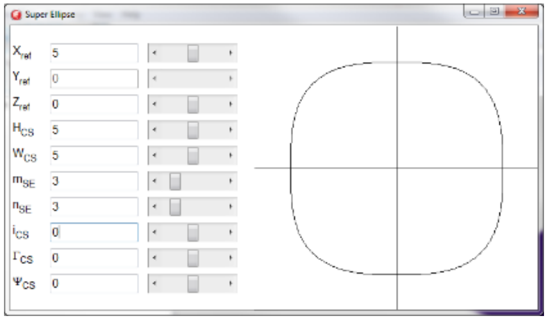
Component Toolbar: Body Example

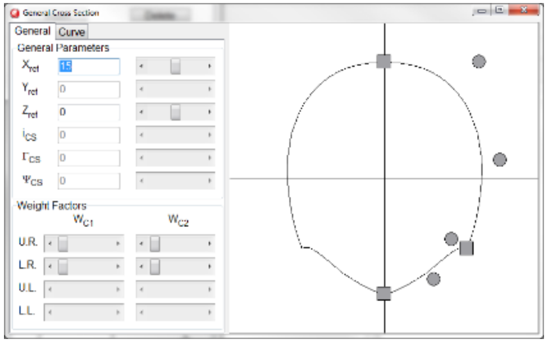


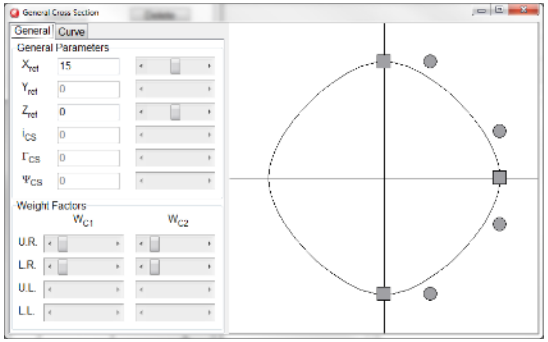
Body Properties Definition

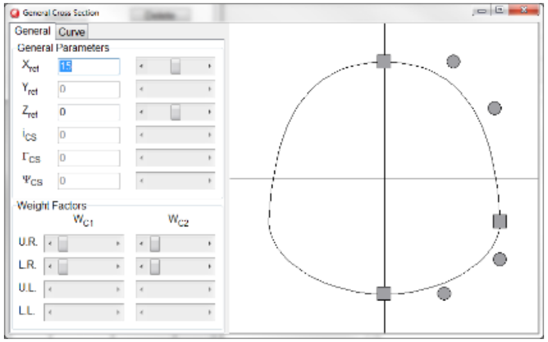


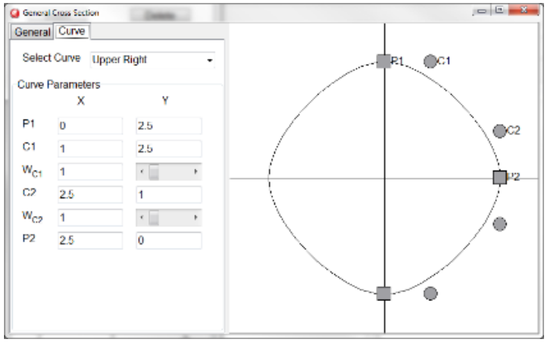
Body Cross Section Generation

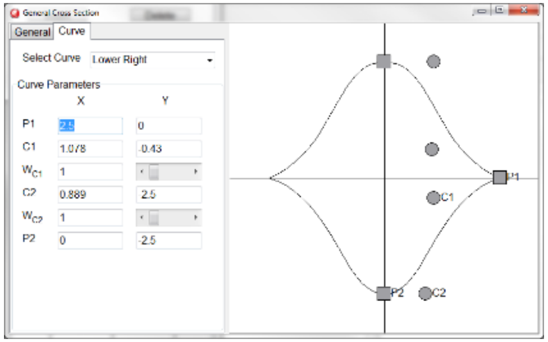




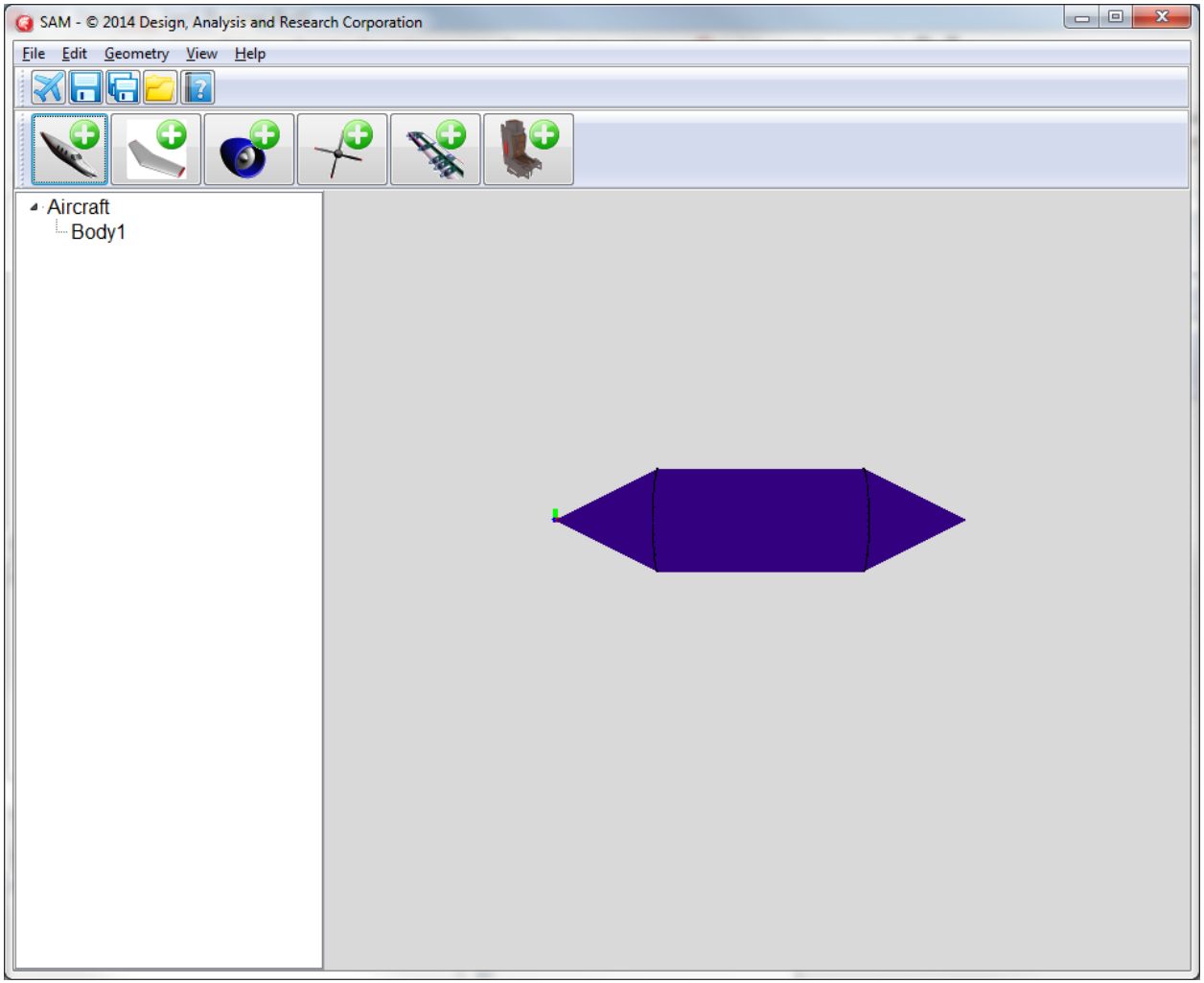




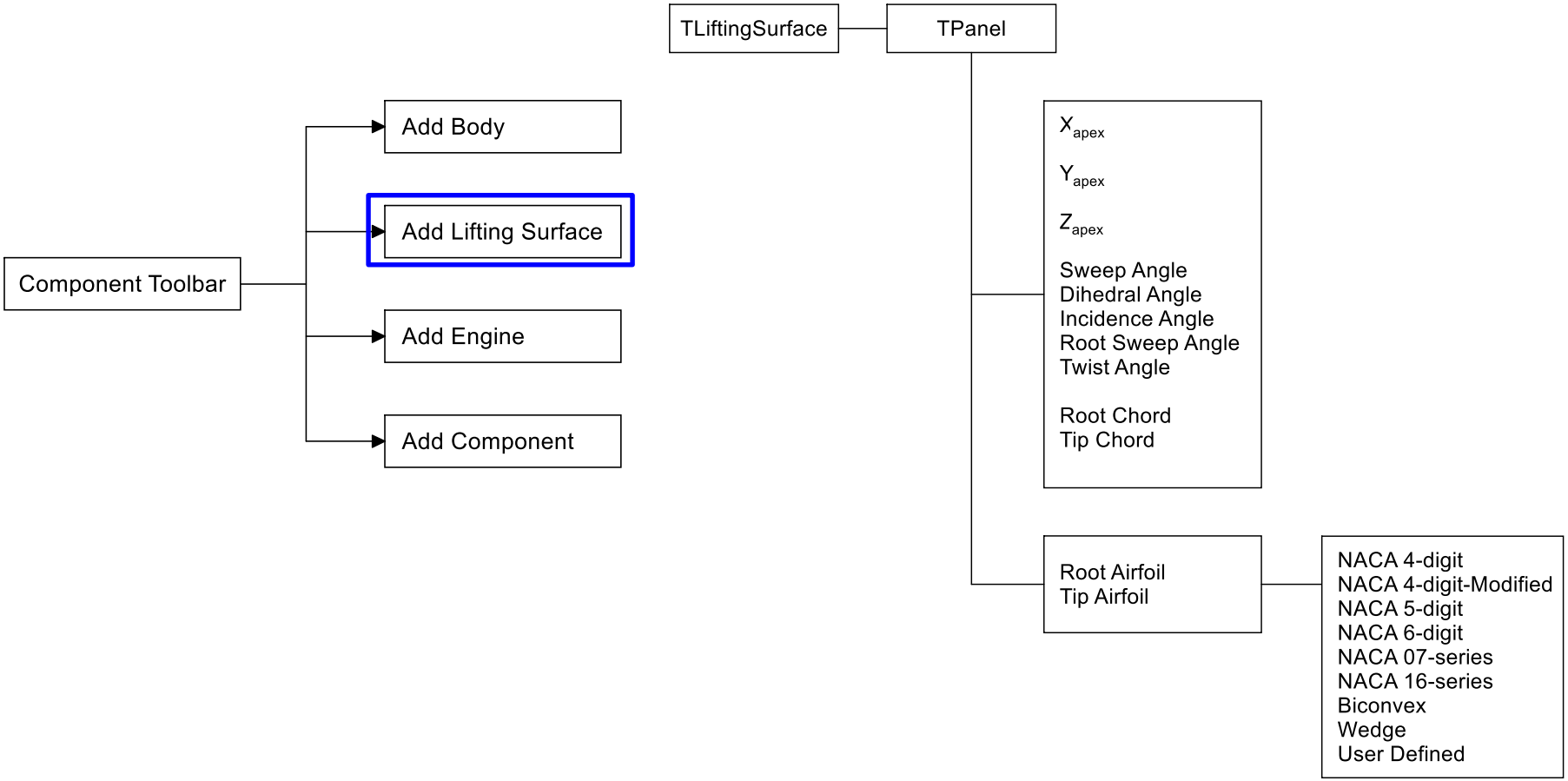




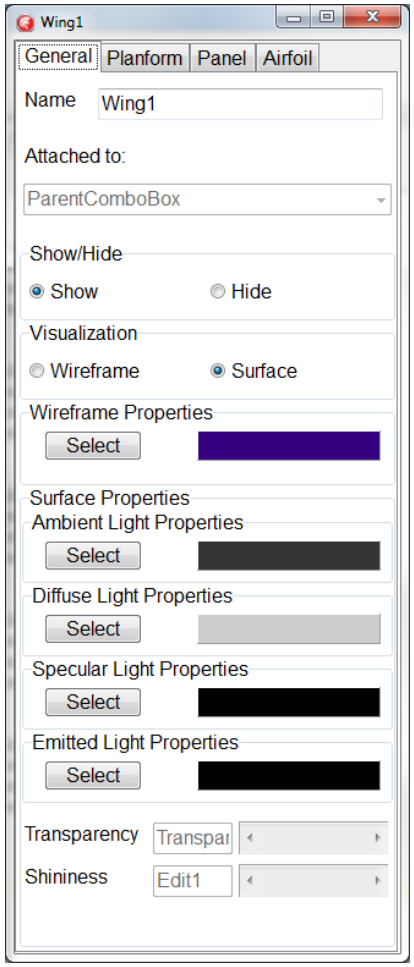
Addition of Body to Main Window

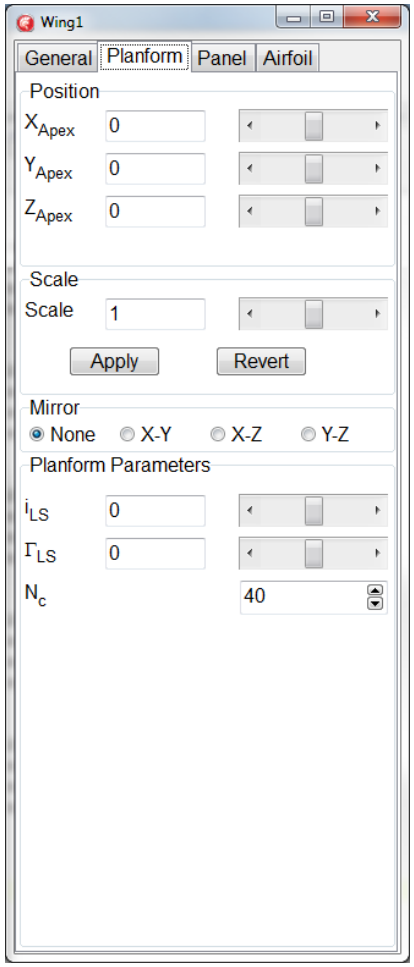


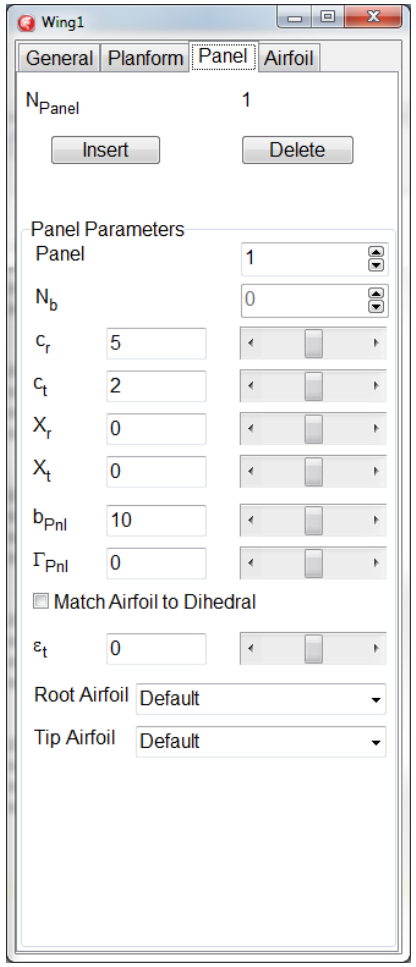
Component Toolbar: Lifting Surface Example

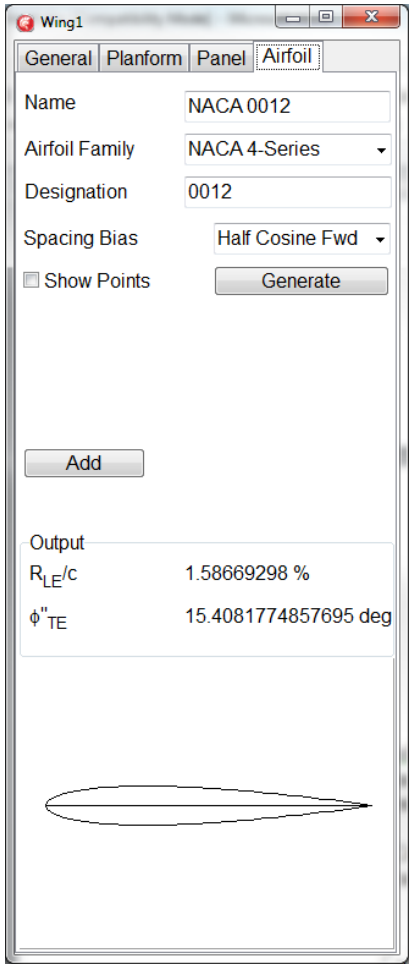


Lifting Surface Properties Definition



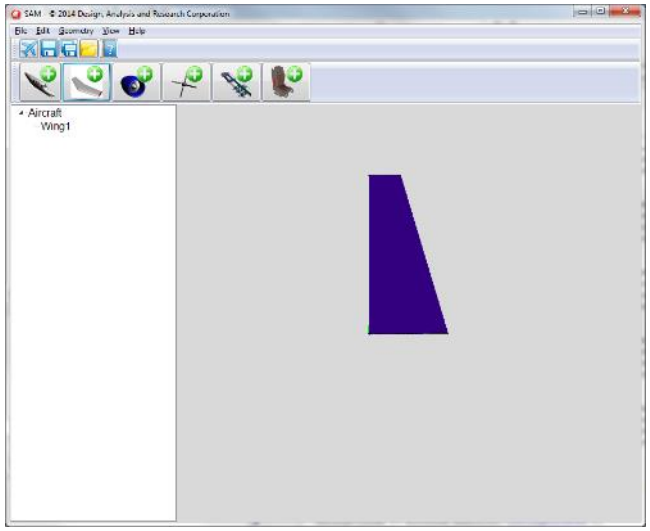




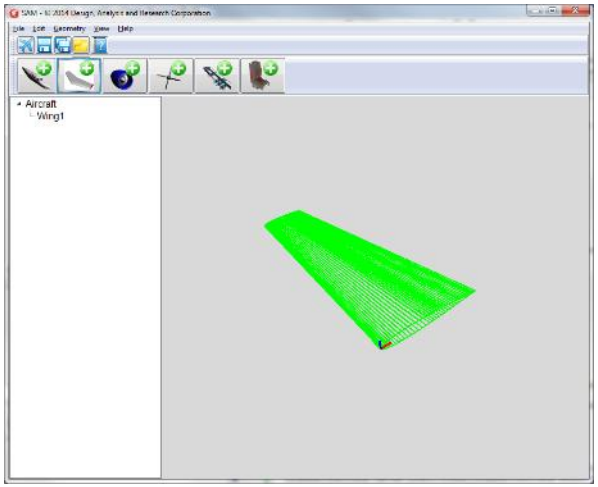


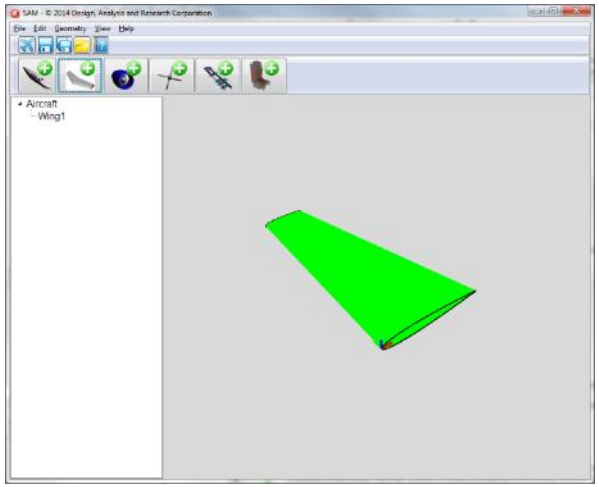
Enhanced 3-D Geometry Module

Addition of Lifting Surface to Main Window

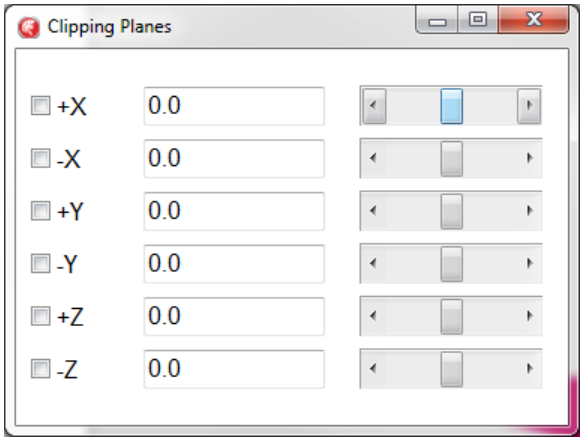


Lifting Surface Wireframe and Surface Skin

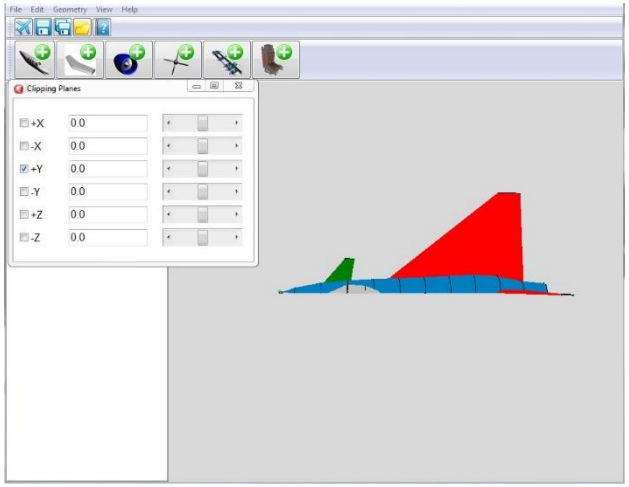


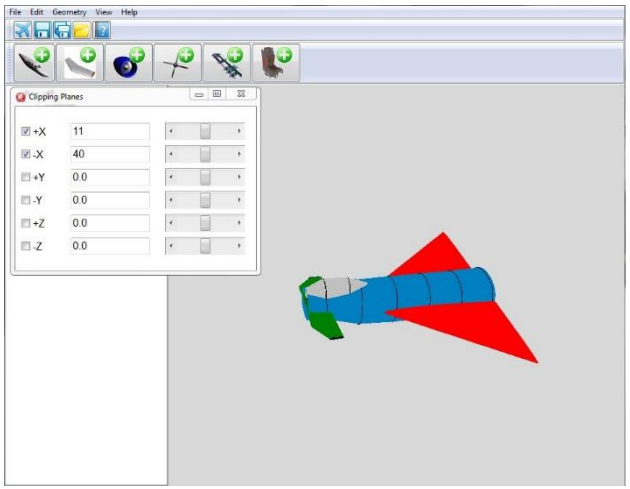


Clipping Plane Selection Window

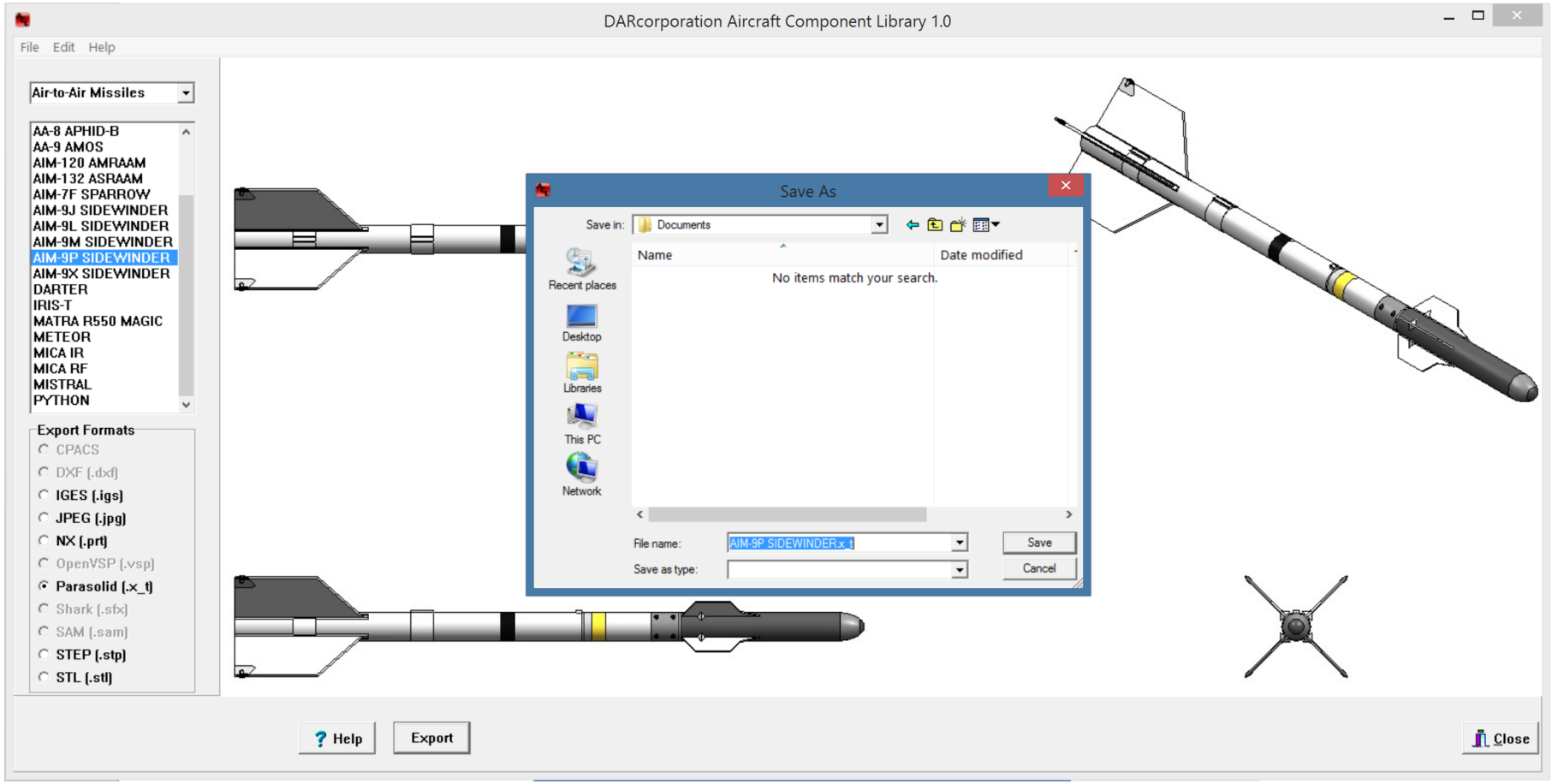


Clipping Plane Example





ACL


DARcorporation Aircraft Component Library 1.0
File Edit Help
Air-to-Air Missiles
AA-8 APHID-B
AA-9 AMOS
AIM-120 AMRAAM
AIM-132 ASRAAM
AIM-7F SPARROW
AIM-9J SIDEWINDER
AIM-9L SIDEWINDER
AIM-9M SIDEWINDER
AIM-9P SIDEWINDER
AIM-9X SIDEWINDER
DARTER
IRIS-T
MATRA R550 MAGIC
METEOR
MICA IR
MICA RF
MISTRAL
PYTHON
Export Formats
CPACS
DXF (.dxf)
IGES (.igs)
JPEG (.jpg)
NX (.prt)
OpenVSP (.vsp)
Parasolid (.x_t)
Shark (.sfx)
SAM (.sam)
STEP (.stp)
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Save As
Save in: Documents
Recent places
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Date modified
No items match your search.
File name: AIM-9P SIDEWINDER.x_t
Save as type:
Save
Cancel
Help
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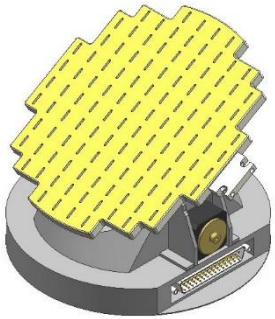
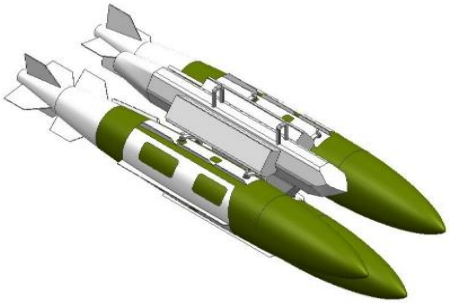
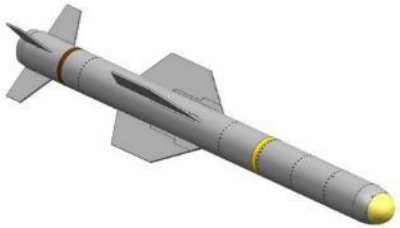
Close

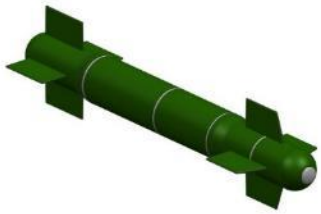
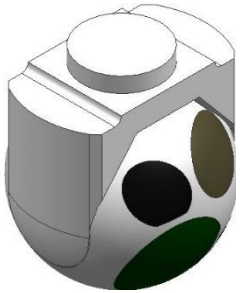
Summary (cont'd)

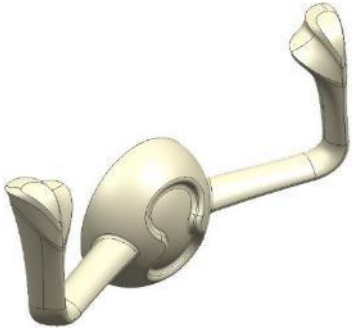
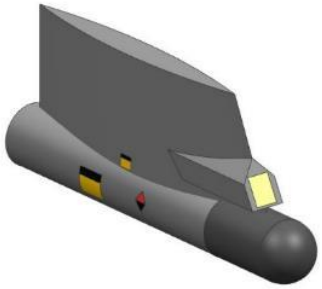
ACL

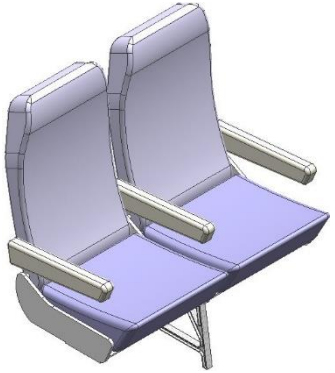
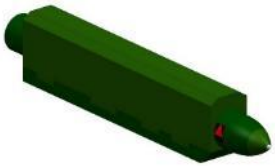
Name	Number of Models
Aircraft	>100
Air-to-Air Missiles	23
Air-to-Ground Missiles	26
Anti-Ship Missiles	6
Bombs	25
Controls	5
Ejection Seat	1
Engines	7
External Fuel Tanks	5
Gimbal Sensors	4
Gun Pods	5
Guns	9
Helmet	1
Human	1
Mission Pods	10
Radar and Antenna	8
Seats	4
Vehicles	4
Weapon Racks	9

ACL

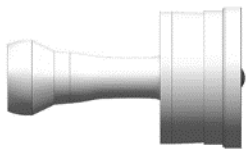
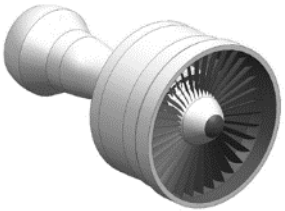
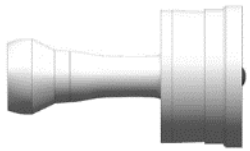




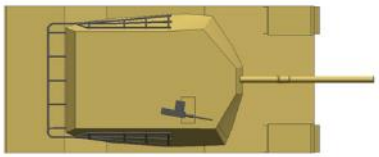
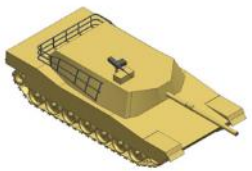

PW2000


GAU-2A 7.62mm Gun



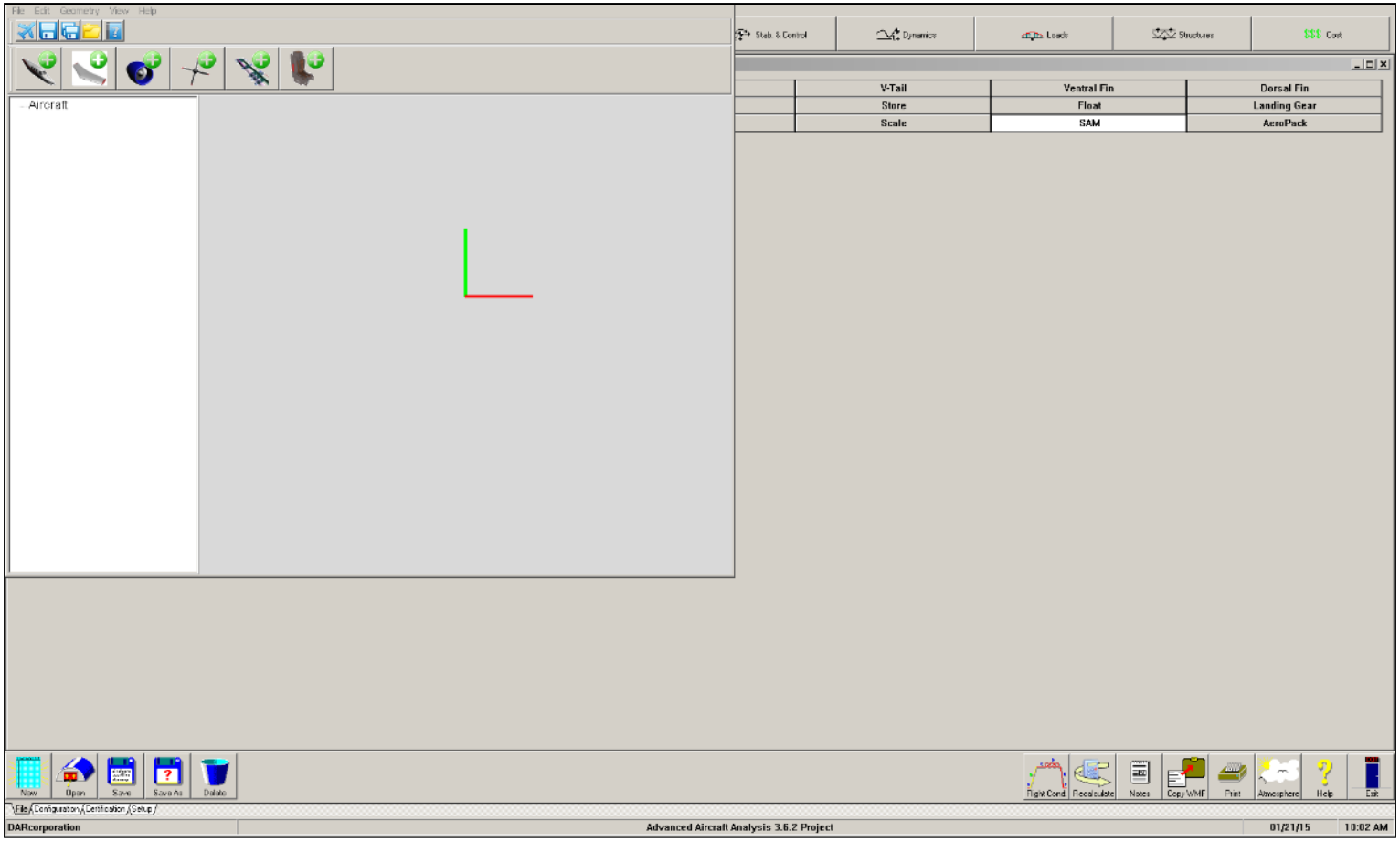

M1A1 Abrams

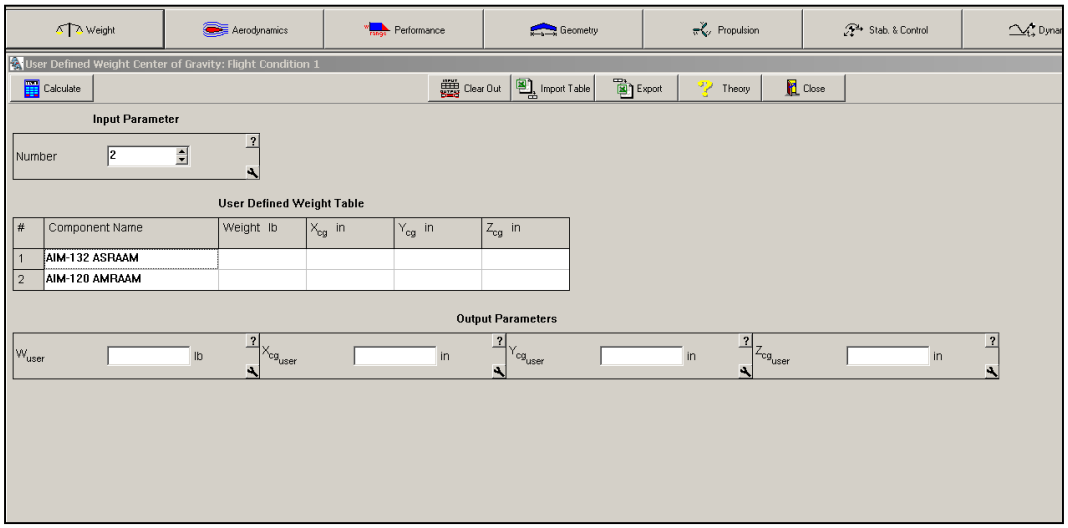
UL260I

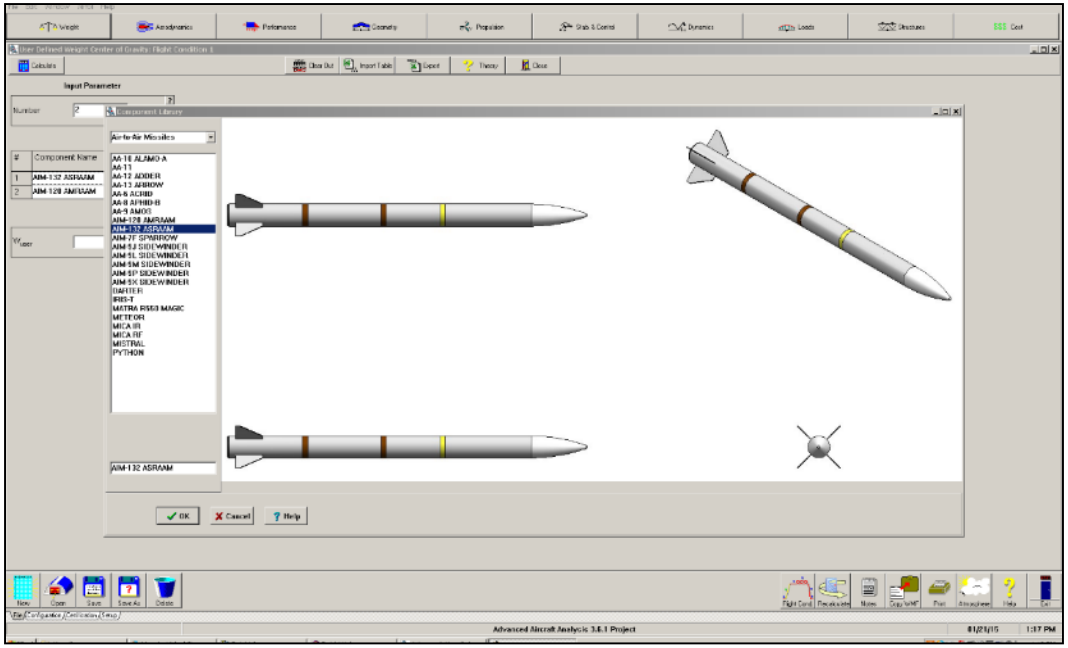



SAM in AAA Framework



ACL in AAA Framework

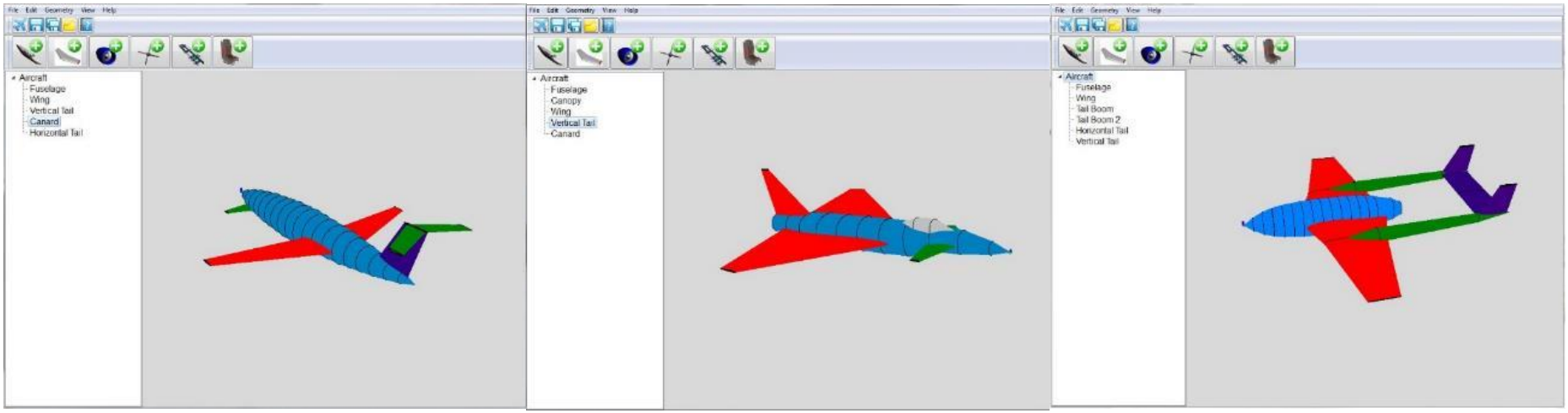




Summary

SAM:

- 3-D Parametric Modeling
- Quick Generation of Novel Layouts
- Inboard Profile
- Backward Compatible with AAA
- Export/Import Options from Shark/AeroPack
- CPACS



Future Work

- Further Implementation in AAA
- Smart**er** Aircraft Modeler:
  - Increased number of Data Exchange Formats
  - Knowledge Based
  - Improved Input

Smarter Geometry Input?

Future Work: Other

- Database of Aircraft (> 100 examples)
- Batch Mode for MDO
- Linking to Panel Code/CFD
- Linking to Flight Dynamics (J2Aircraft)
- Airplane Sizing
- SolidWorks/AeroPack
- Siemens NX/AeroPack

Thank You

Questions?

TUESDAY, JANUARY 05, 2016

ACD-01. Aircraft Design Issues I
ACD-02. Aircraft Design Issues II
ACD-03. Aircraft Wing Design

WEDNESDAY, JANUARY 06, 2016

ACD-04. Electric Aircraft Design
ACD-05. Transport Aircraft Design I
ACD-06. Aircraft Design Tools
ACD-07. Transport Aircraft Design II

THURSDAY, JANUARY 07, 2016

ACD-08. Unmanned Aerial Vehicle Design
ACD-09. Conceptual Aircraft Design Working
GNC-30/ACD-10. Aircraft GNC I
ACD-11. Micro Air Vehicle Design
GNC-34/ACD-12. Aircraft GNC II

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ACD-13. Aircraft Design Optimization