OpenVSP-Connect – Visualize Your Aircraft Sizing Results with NASA’s Vehicle Sketch Pad

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OpenVSP-Connect – Visualize Your Aircraft Sizing Results with NASA’s Vehicle Sketch Pad

Abstract

A 3D visualization is missing for many aircraft preliminary sizing tools. NASA’s Open Vehicle Sketch Pad (OpenVSP) is easy to use, but lacks an interface to input consistent aircraft data. Such an interface has been programmed and is called OpenVSP-Connect. Aircraft are sketched from about 50 parameters. If these are not known to the user, the interface calculates them as good as possible based on simple equations from aircraft design or statistics. Taken this to the extreme, a decent looking aircraft is drawn from as few as two or three input parameters.
OpenVSP-Connect – Visualize Your Aircraft Sizing Results with NASA’s Vehicle Sketch Pad

Contents

• OpenVSP

• Three Approaches to Visualization with OpenVSP

• OpenVSP-Connect

• Summary
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OpenVSP

vehicle sketch pad  
join us

innovate  
analyze  
get it

NASA open source parametric geometry

www.openVSP.org
OpenVSP

Download and Install

Getting started with VSP is easy. If you’re on Windows or MacOS, visit the download page and pull down the latest version ready-to-go. If you’re on Ubuntu, there are some installation instructions on the Wiki; installation on most other Linux distributions should be similar.

Tutorials

VSP is very easy to use. Most users get the hang of it after just a few minutes. If you’re looking for more help, there are some tutorial videos and a downloadable manual which help you get started in VSP.

VSP Hangar

The VSP Hangar is a database of community contributed example models. Check it out for a starting point or just for inspiration. Once you’ve completed your first model, show it off by contributing it to the hangar.
User Manual

81 pages
OpenVSP Google Group
OpenVSP

OpenVSP is a parametric aircraft geometry tool. OpenVSP allows the user to create a 3D model of an aircraft defined by common engineering parameters. This model can be processed into formats suitable for engineering analysis.

The predecessors to OpenVSP have been developed by J.R. Gloudemans and others for NASA since the early 1990's. On January 10 2012, OpenVSP was released as an open source project under the NASA Open Source Agreement (NOSA) version 1.3.

FAQ

Installation Instructions

Developer Instructions

API Use Cases
OpenVSP Frequently Asked Questions and Tips

Known Bugs and Workarounds

1. The airfoil picture covers the Wing editor on MacOS.
   - When using OpenVSPmac2.0.3 or earlier, the airfoil cross-section plot persists when you leave the Foil tab of the MS_Wing editor. This is a known bug. Until it is fixed, the workaround is pretty easy. Once you leave the Foil tab by selecting another tab in the MS_Wing editor, simply click on the component name in the Geom Browser (usually sitting just to the left of the MS_Wing editor). This will force a refresh of the MS_Wing editor window.
## OpenVSP Hangar

### Filter Results

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<th>Source Quality</th>
<th>Manufacturers</th>
<th>Tag</th>
<th>Model</th>
<th>Downloads</th>
<th>Comments</th>
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Boeing 787-300

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Description: A general, non-exact Boeing 787-300 model

Source Quality:
3 - The source material used to create this model was Good. This means good 3-view drawings were used to create the model.

Model Suitability:
2 - Cartoon or Pretty Picture
2 - Weight and balance
2 - OML for wetted areas/drag buildup
2 - Check internal layout/volume
2 - Structures
2 - Build a display model
3 - Accurate OML for detailed aerodynamic analysis or CFD

Tags: airplane, transport
Boeing 787-300

OpenVSP Hangar

hangar.openvsp.org

X3DOM
LOADING SCENE...
OpenVSP

Papers about VSP


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Three Approaches to Visualization with OpenVSP

Open Vehicle Sketch Pad Aircraft Modeling Strategies

Andrew S. Ihahn

NASA Langley Research Center, Hampton, VA, 23681

Geometric modeling of aircraft during the Conceptual design phase is very different from that needed for the Preliminary or Detailed design phases. The Conceptual design phase is characterized by the rapid, multi-disciplinary analysis of many design variables by a small engineering team. The designer must walk a line between fidelity and productivity,

...
Three Approaches to Visualization with OpenVSP

*Hahn*: There are **two basic kinds of models created in Open VSP**:

The **first approach** is the “clean sheet” design in which the **parameters are all chosen** by the designer using Open VSP. In this case, there is no other geometry and so this model is considered definitive.

The **second approach** basic kind of model is the “match” design. … In this case, there is some other standard of comparison, be it a real aircraft or a geometry from a different modeler such as CAD. It takes significantly more effort to produce a model that is as good of a representation as possible. Usually, the only **geometric information available is limited tabular data and a three-view drawing**. There are different ways of building this kind of model, but the preferred way is to gather the most accurate information and then expend some effort to **derive the parameters that Open VSP needs** to create the model.
Three Approaches to Visualization with OpenVSP

The **first** approach: „clean sheet“ design

- **Hand Sketches**

- **Creative Methods**
  - Brainstorming
  - Gallery Method

- **Visualization with OpenVSP**
The second approach: „match“ design
Three Approaches to Visualization with OpenVSP

The **third approach**: „calculated“ design

- **Simple Aircraft Sizing**
- **Parametric CATIA**
- **OpenVSP**
- **CEASIOM: AcBuilder**
- **SUMO**
Three Approaches to Visualization with OpenVSP

RASCE

Rapid Air System Concept Exploration

RASCE is developed by Armand J. Chaput, and is distributed with the following license statement.
Three Approaches to Visualization with OpenVSP

Rapid Air System Concept Exploration (RASCE)

**Overview**
*July 2009*

**University of Texas at Austin Air System Laboratory**
Armand J. Chaput, Director

© 2009 Armand J. Chaput

See also:
OpenVSP-Workshop 2012
Three Approaches to Visualization with OpenVSP

Summary

RASCE - a physics-based, conceptual level, air system design and analysis M&S environment developed to provide students with hands-on experience in air system design including real world design drivers not typically taught
- In continuous use since 2003 on student design projects
- Also applied to government and industry concept studies

RASCE is particularly well suited for concept screening and quantitative design and technology trade studies
- Configuration features and trade offs can be carefully and systematically controlled over a broad trade space

RASCE runs in real time on a standard laptop
- No laborious input data preparation and/or hand calculations

Experienced users can go from initial concept to complete air system sized to standard mission rules in < 1 hour

© 2000 Armand J. Chaput
Three Approaches to Visualization with OpenVSP

3D model output rendered by SolidWorks

3D Rendering of Aircraft Configuration Designs

© 2009 Armand J. Chaput
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OpenVSP-Connect is primarily intended as an interface tool between ANY aircraft design tool and Open Vehicle Sketch Pad (openVSP) from NASA. OpenVSP-Connect needs OpenVSP for the display of the aircraft. You can download OpenVSP for free:
http://www.openVSP.org

In the order of 50 core parameters of the aircraft are used to calculate the input parameters required by OpenVSP to sketch a passenger aircraft. For each parameter, a proposed value is given and automatically applied as long as the user does not specify his/her own value.

By using all default values, the program works in "automatic mode": Based on just two input values "Cruise Mach number" and "Number of passengers" an aircraft can be sketched automatically based on passenger aircraft statistics.

For further information, documentation please refer to:
http://OpenVSP-Connect.ProfScholz.de

OpenVSP-Connect is a project by Aircraft Design and Systems Group (AERO) at Hamburg University of Applied Sciences (HAW Hamburg).
OpenVSP-Connect

OpenVSP-Connect is primarily intended as an interface tool between ANY aircraft design tool and Open Vehicle Sketch Pad (openVSP) from NASA.

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By using all default values, the program works in "automatic mode": Ultimately, based on just three input values "Number of passengers“, “Range” and "Cruise Mach number" an aircraft can be sketched automatically based on passenger aircraft statistics.
### Convert to OpenVSP XML

Convert data from Input-Tab to an OpenVSP XML file.

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### OpenVSP-Connect

#### 4. Vwing

- **Wing Type**: Double-trapezoidal
- **Total Area**: 120,000 [m²]
- **Total Aspect ratio**: 3.481
- **Root chord**: 2180 [m]
- **Tip chord**: 5339 [m]
- **Root Chord**: 1.176
- **Tip chord**: 1.176
- **Thickness ratio**: 8.116
- **X position of wing**: 31500 [% of fuselage length]
- **Center of airfoil thickness**: 0.515
- **Relative xthk position**: 0.515
- **Inboard leading edge sweep**: 24.234 [°]
- **Inboard trailing edge sweep**: 0.000
- **Inboard dihedral angle**: 2512 [°]
- **Fuselage length**: 35.827 [m]
- **Nose length**: 6.107 [m]
- **Cockpit length**: 2.562 [m]
- **Fuselage tail length**: 13.035 [m]
- **Cylinder length**: 16.604 [m]

#### 5. Fuselage

- **Fuselage diameter**: 3.356 [m]
- **Fuselage length**: 35.827 [m]
- **Nose length**: 6.107 [m]
- **Cockpit length**: 2.562 [m]
- **Fuselage length**: 35.827 [m]
- **Nose length**: 6.107 [m]
- **Cockpit length**: 2.562 [m]
- **Fuselage tail length**: 13.035 [m]
- **Cylinder length**: 16.604 [m]

#### 6. Horizontal Tail
OpenVSP-Connect

Input of Aircraft Design Parameters

Enter the results from any aircraft sizing or aircraft conceptual design tool. If data is unknown, use values as proposed here.

Aircraft Name: AeroAircraft
Description: more info ...

Action buttons:
- Open File in OpenVSP: Convert your data into an OpenVSP readable format and open it in OpenVSP. Ensure that cell marked as OpenVSP_Dir on the side of this box is filled correctly.
- See changes made in OpenVSP: After saving changes of your file in OpenVSP, click this button to see your changes in Excel. The path of this file is taken from openvsp-file on the right of this box.
Summary

- OpenVSP-Connect is primarily intended as an interface tool between ANY aircraft design tool and Open Vehicle Sketch Pad (openVSP) from NASA.

- For each parameter a proposed value is given and automatically applied as long as the user does not specify his/her own value.

- By using all default values, the program works in "automatic mode": Ultimately, based on just three input values "Number of passengers“, “Range” and "Cruise Mach number" an aircraft can be sketched automatically based on passenger aircraft statistics.
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