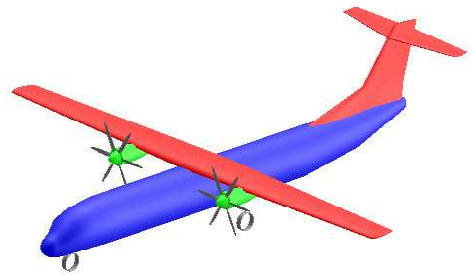
Hochschule für Angewandte Wissenschaften Hamburg
Hamburg University of Applied Sciences

AIRCRAFT DESIGN AND SYSTEMS GROUP (AERO)

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



Dieter Scholz — Hamburg University of Applied Sciences
Tahir Sousa — Hamburg University of Applied Sciences

http://ewade2013.AircraftDesign.org
http://dx.doi.org/10.5281/zenodo.546617
http://openVSP.ProfScholz.de

CEAS European Air & Space Conference 2013
Linköping, Sweden
16 to 19 September 2013

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.

Contents

- OpenVSP
- Three Approaches to Visualization with OpenVSP
- OpenVSP-Connect
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OpenVSP

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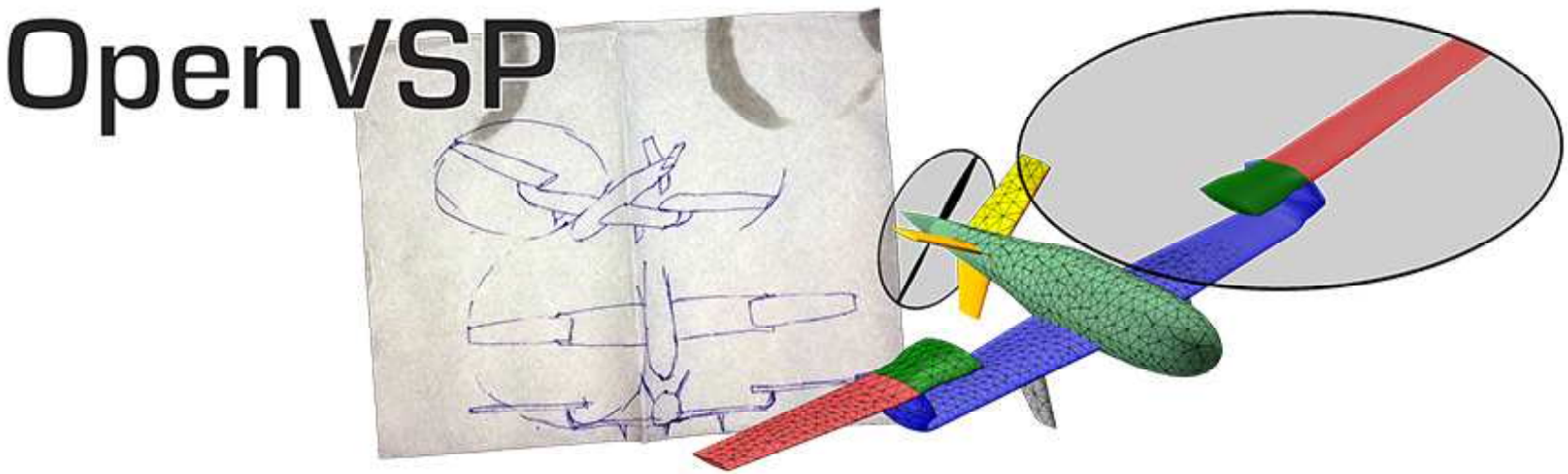


www.openVSP.org

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.

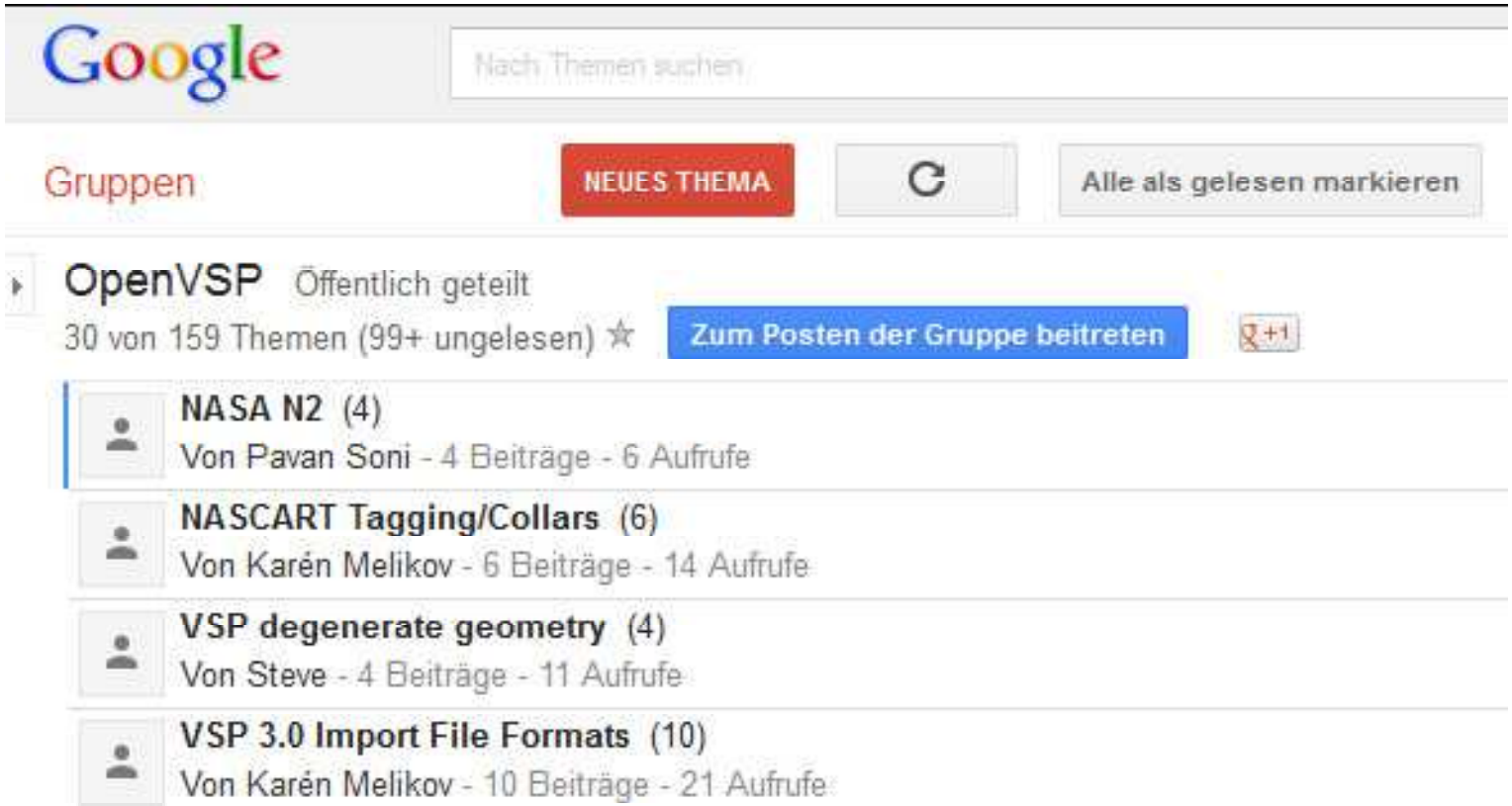
VSP Hangar

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

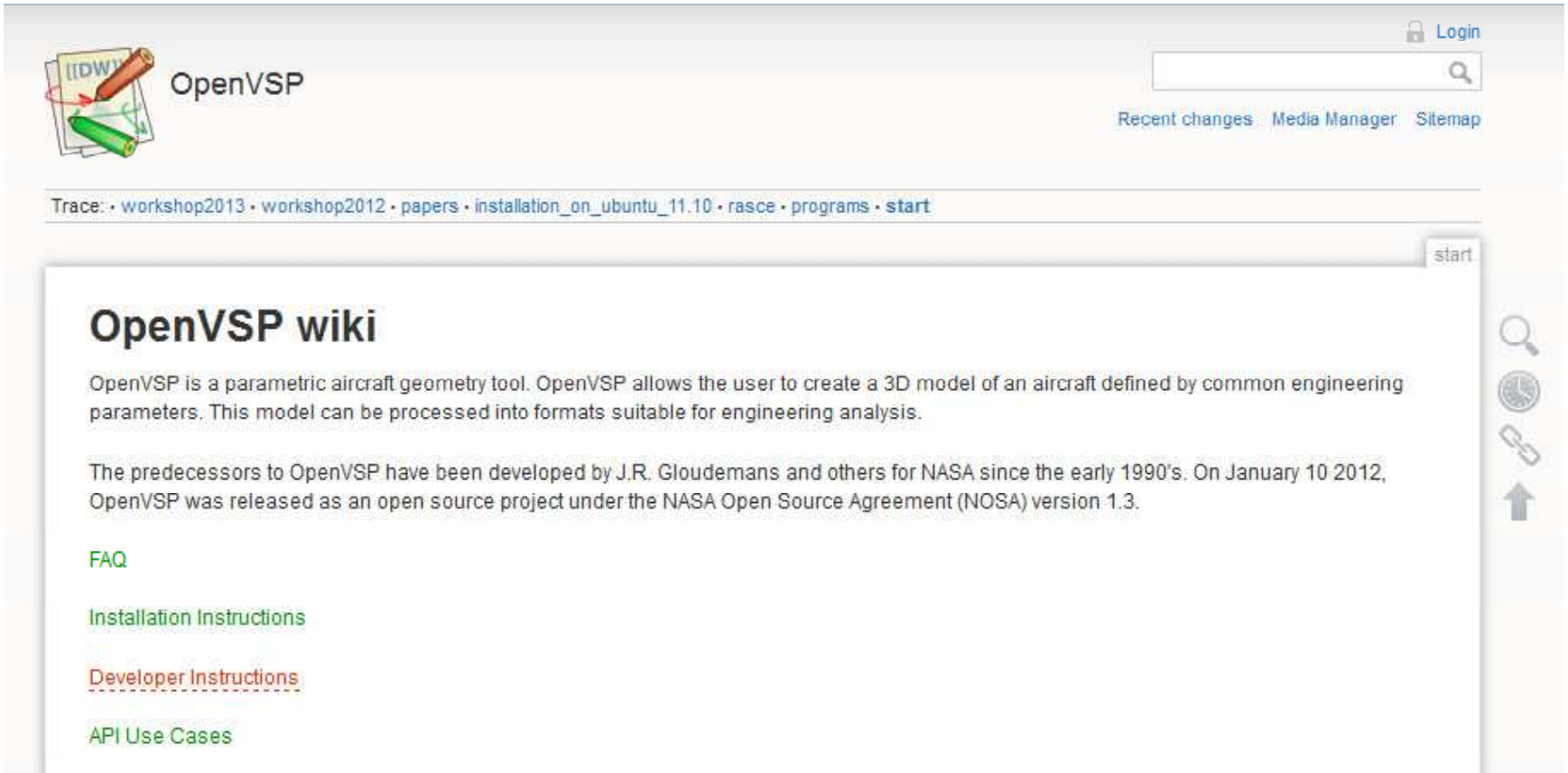
81 pages

OpenVSP



OpenVSP Google Group

OpenVSP


OpenVSP
Login
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Media Manager
Sitemap
Trace: • workshop2013 • workshop2012 • papers • installation_on_ubuntu_11.10 • rasce • programs • start
start
OpenVSP wiki
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


OpenVSP
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Trace: • workshop2013 • workshop2012 • papers • installation_on_ubuntu_11.10 • rasce • programs • start • faq
faq
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

Filter Results

Source Quality
- 5 - Completely Inaccurate (1)
- 1 - Definitive (1)
- 2 - Essentially Exact (3)
- 3 - Good (11)

Manufacturers
- (5)
- Bombardier (3)
- NASA (3)
- Boeing (2)
- MIT (1)
- McDonnell Douglas (1)
- Embraer (1)

Units
- feet (14)
- dimensionless (2)

Tags
- transport (16)
- airplane (15)
- airliner (7)
- turboprop engine (3)
- twin-engine (3)
- blended wing body (2)
- lifting body (2)
- utility (1)

Filter Results

Name	Source Quality	Manufacturer	Model	Downloads	Comments	Date
IK-02	3			43	0	2013-02-24
IK-01	3			33	0	2013-02-24
LJJ-3X1	5		Jumbo Luxuryliner/ Cargo Transport	42	0	2013-01-31
DC-10	3	McDonnell Douglas	DC-10	99	0	2013-01-23
Bombardier Dash 8 Q400 clean w/o prop	2	Bombardier	Q400	144	0	2012-10-11
Bombardier Dash 8 Q400 clean w/o prop	2	Bombardier	Q400	70	0	2012-10-10
Bombardier Dash 8 Q400 clean	2	Bombardier	Q400	131	0	2012-10-04
ATR 42-600 Hybrid Electric	3		Hybrid ATR-42	119	0	2012-08-15
ATR 42-600	3	Embraer	ATR-42-600	129	0	2012-08-15

OpenVSP Hangar

OpenVSP

OpenVSP | VSP Hangar | Advanced Search | Upload | Help | Sign in

Boeing 787-300

OpenVSP Hangar

File ID#	61
Manufacuter	Boeing
Model	787-300
Units	Feet
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

left-click = rotate, middle-button/CTLR-left-click = pan, scroll/right-click/ALT-left-click = zoom

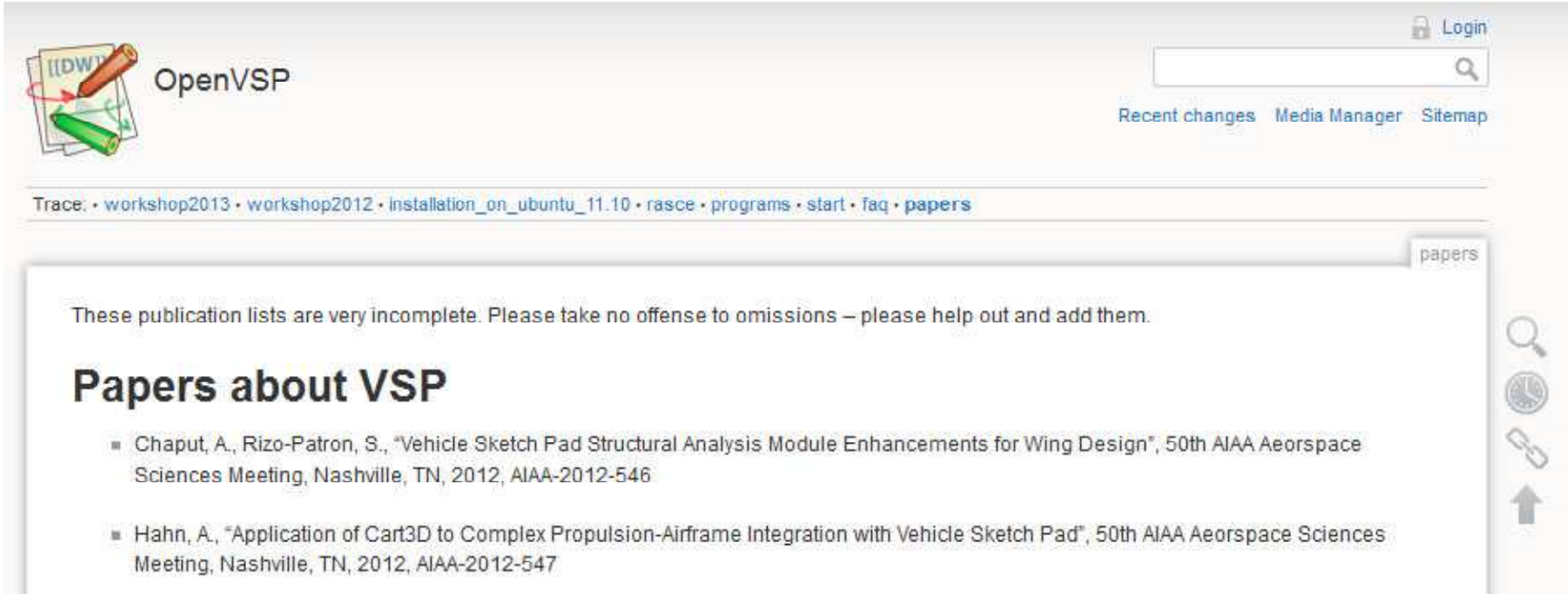
Download | Revisions (0)

OpenVSP

hangar.openvsp.org

OpenVSP Hangar

OpenVSP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papers
These publication lists are very incomplete. Please take no offense to omissions – please help out and add them.
Papers about VSP
Chaput, A., Rizo-Patron, S., "Vehicle Sketch Pad Structural Analysis Module Enhancements for Wing Design", 50th AIAA Aeorspace Sciences Meeting, Nashville, TN, 2012, AIAA-2012-546
Hahn, A., "Application of Cart3D to Complex Propulsion-Airframe Integration with Vehicle Sketch Pad", 50th AIAA Aeorspace Sciences Meeting, Nashville, TN, 2012, AIAA-2012-547

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Three Approaches to Visualization with OpenVSP

Open Vehicle Sketch Pad Aircraft Modeling Strategies

Andrew S. Hahn [1]
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,

...

American Institute of Aeronautics and Astronautics

Three Approaches to Visualization with OpenVSP

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

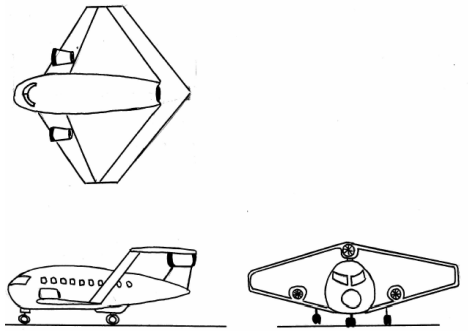
The **first approach** is the **"clean sheet" design** in which the **parameters are all chosen** by the designer using Open VSP. In this case, there is no other geometry and so this model is considered definitive.

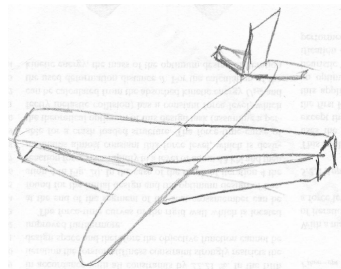
The **second approach** basic kind of model is the **"match" design**. … In this case, there is some other standard of comparison, be it a real aircraft or a geometry from a different modeler such as CAD. It takes significantly more effort to produce a model that is as good of a representation as possible. 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.

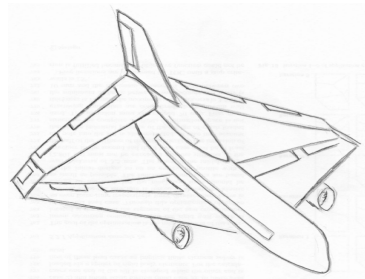
Three Approaches to Visualization with OpenVSP

The first approach: „clean sheet“ design

- **Hand Sketches**

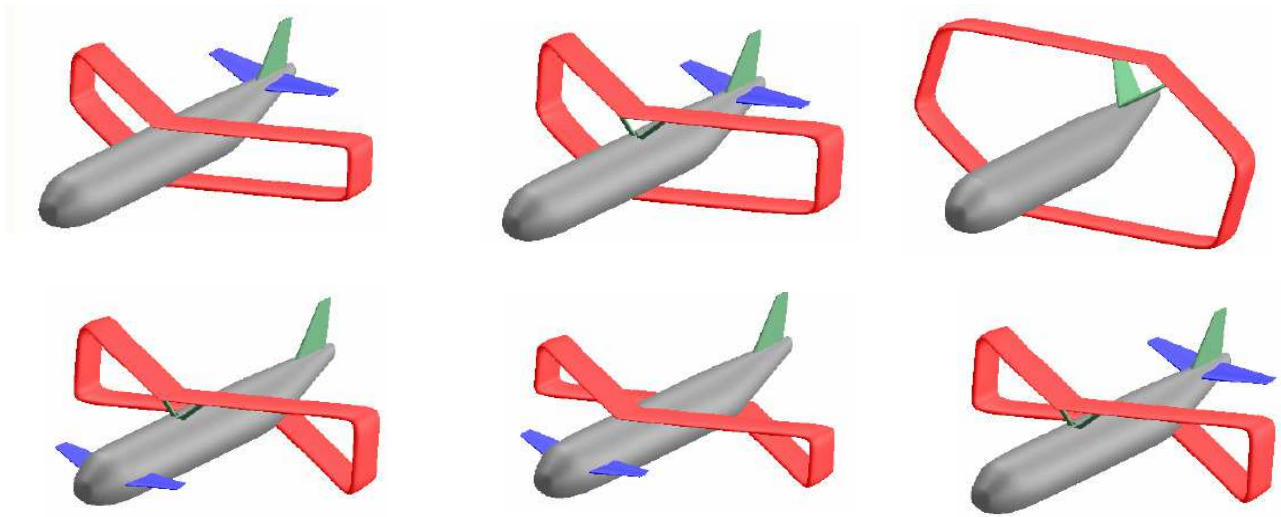






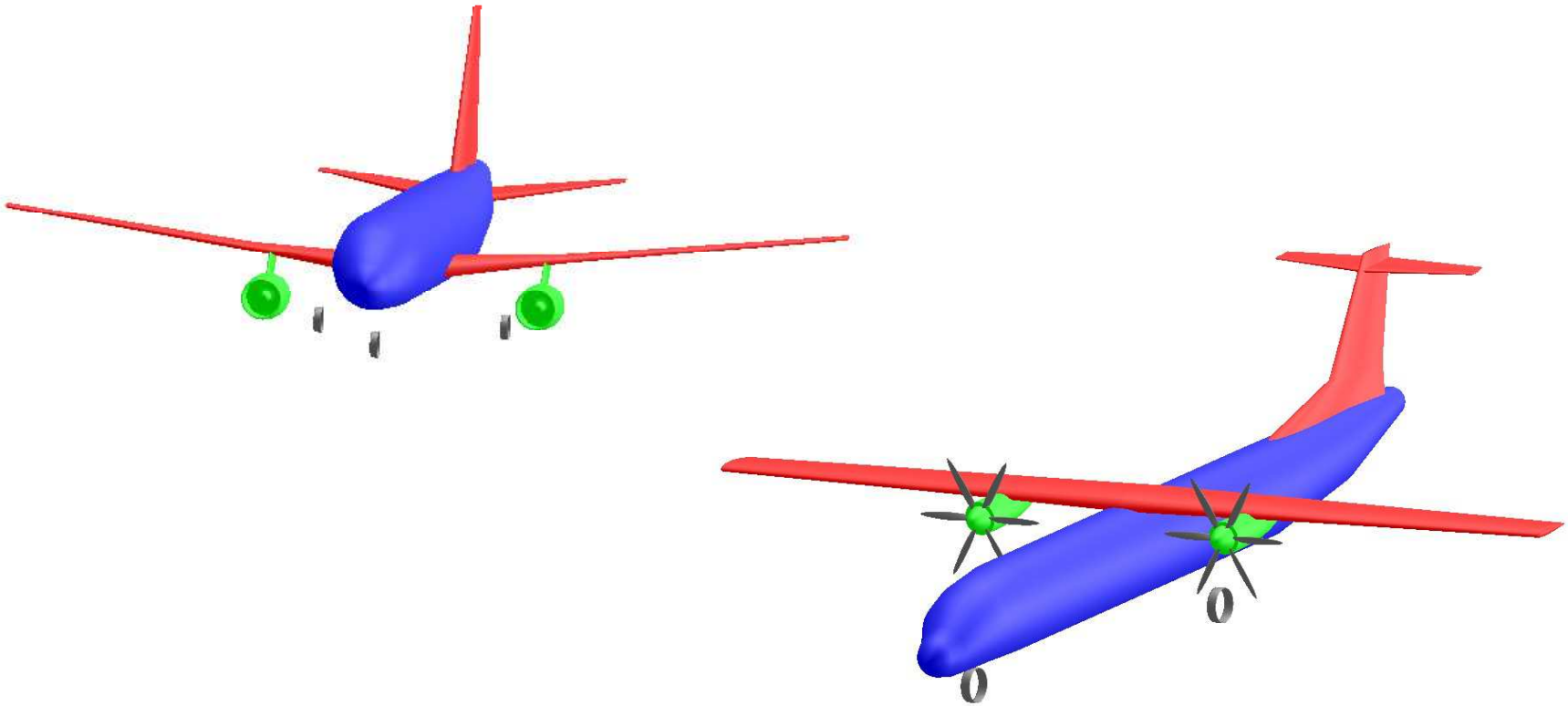
- **Creative Methods**
  - **Brainstorming**
  - **Gallery Method**

- **Visualization with OpenVSP**



Three Approaches to Visualization with OpenVSP

The second approach: „match“ design

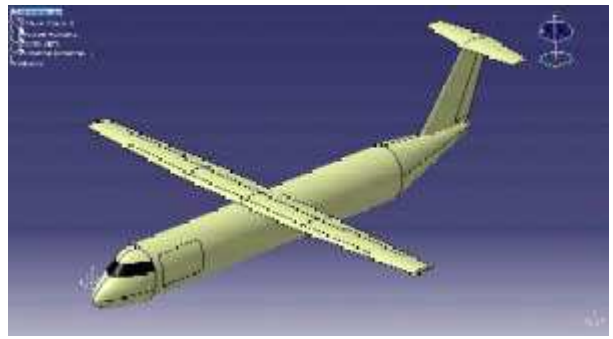


Three Approaches to Visualization with OpenVSP

The third approach: „calculated“ design

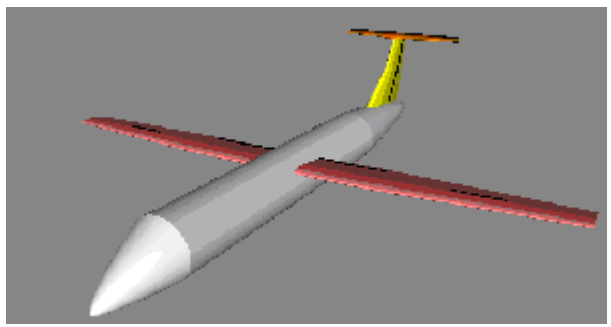
new

Simple Aircraft Sizing

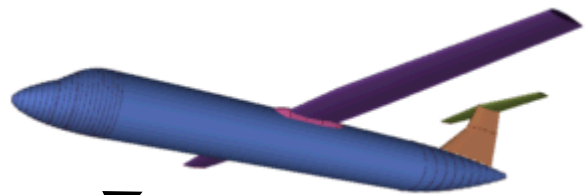


Parametric CATIA

OpenVSP



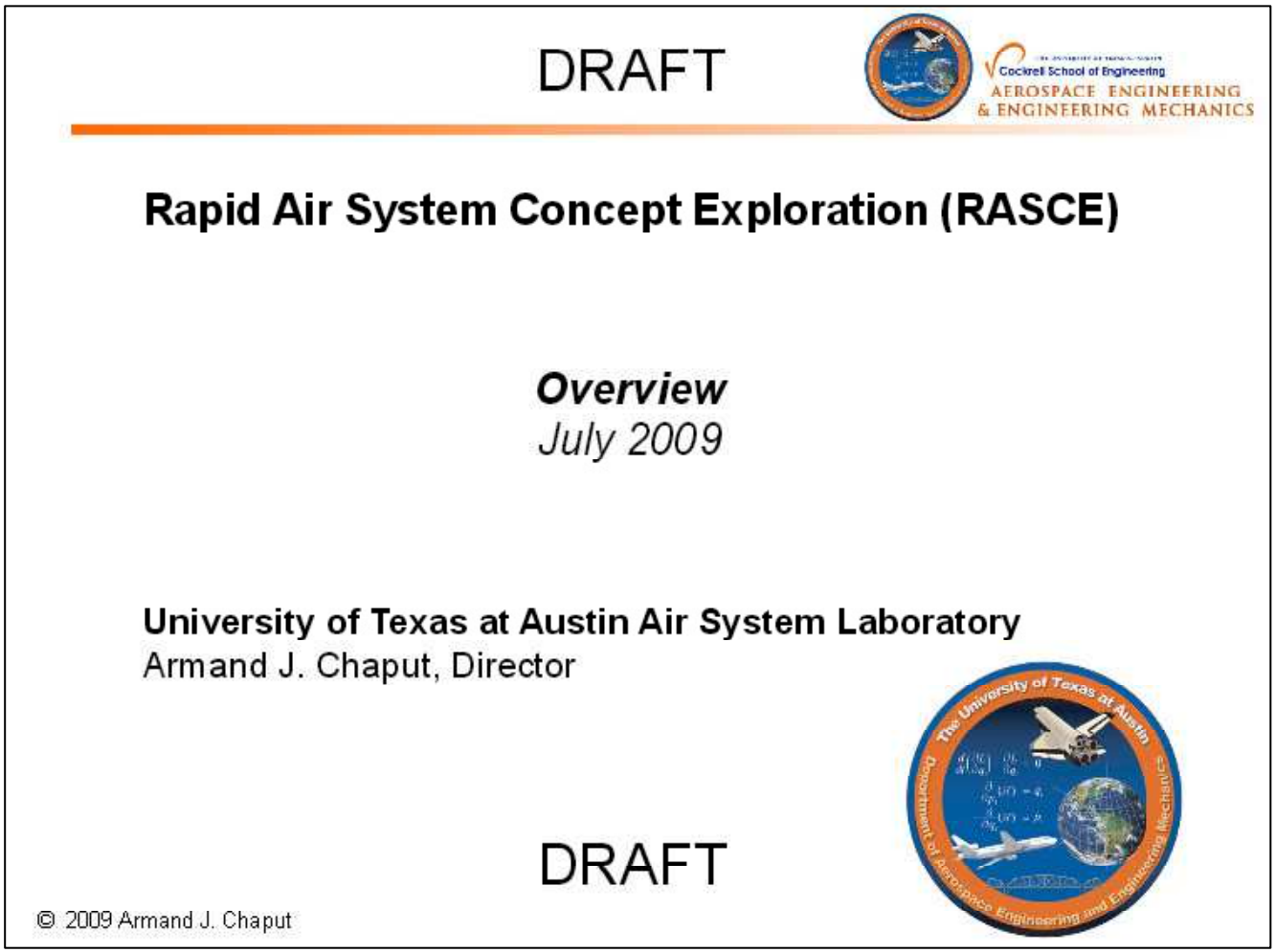
CEASIOM: AcBuilder



SUMO

Three Approaches to Visualization with OpenVSP

Three Approaches to Visualization with OpenVSP



See also:
OpenVSP-Workshop 2012

Three Approaches to Visualization with OpenVSP

Summary

Cockrell School of Engineering
AEROSPACE ENGINEERING & ENGINEERING MECHANICS

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

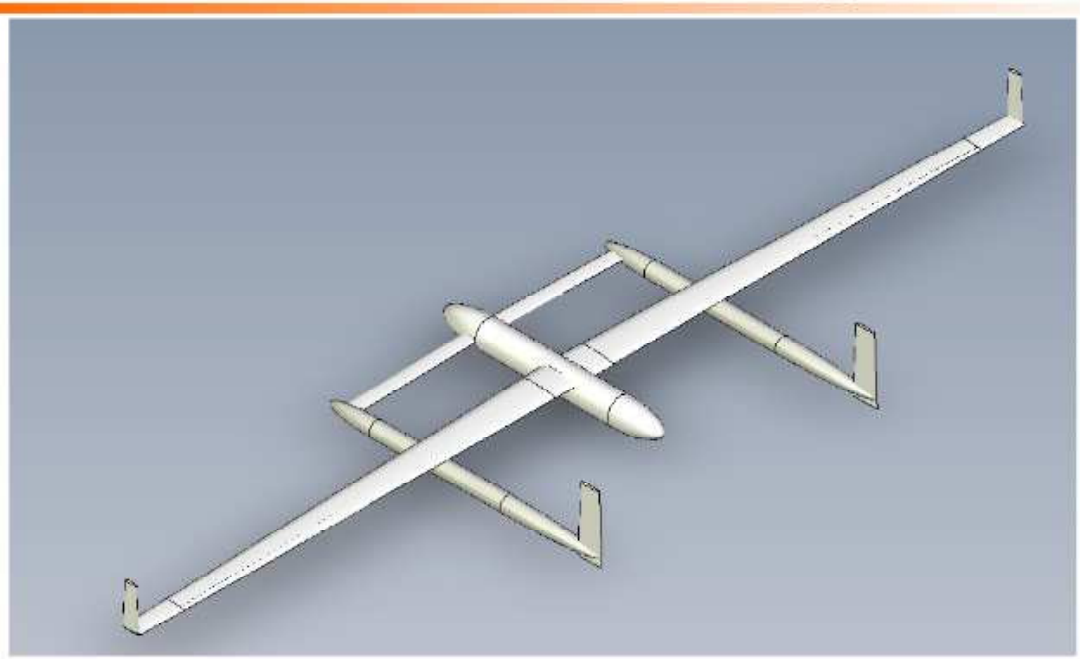
- *No laborious input data preparation and/or hand calculations*

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

Three Approaches to Visualization with OpenVSP

3D model output rendered by SolidWorks

Cockrell School of Engineering
AEROSPACE ENGINEERING & ENGINEERING MECHANICS



3D Rendering of Aircraft Configuration Designs

James R. Carlson[1]
University of Texas, Austin, Texas, 78712

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OpenVSP-Connect

OpenVSP-Connect

Connect YOUR Aircraft Design Tool with Vehicle Sketch Pad from NASA

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).

GPL v3 Free Software

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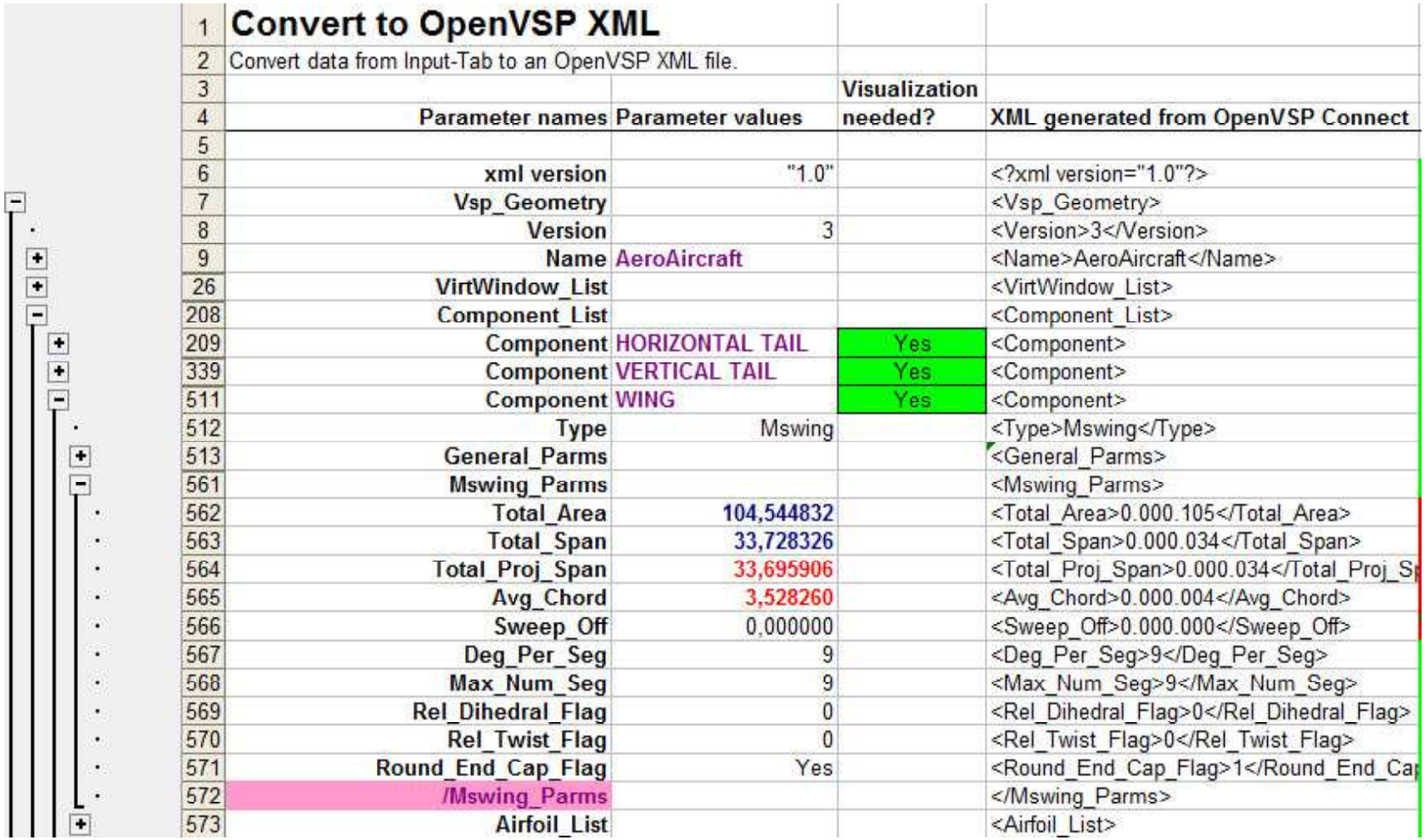
For each parameter a proposed value is given and automatically applied as long as the user does not specify his/her own value.

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.

OpenVSP-Connect



	Convert to OpenVSP XML			
2	Convert data from Input-Tab to an OpenVSP XML file.			
3			Visualization	
4	Parameter names	Parameter values	needed?	XML generated from OpenVSP Connect
5				
6	xml version	"1.0"		<?xml version="1.0"?>
7	Vsp_Geometry			<Vsp_Geometry>
8	Version	3		<Version>3</Version>
9	Name	AeroAircraft		<Name>AeroAircraft</Name>
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570	Rel_Twist_Flag	0		<Rel_Twist_Flag>0</Rel_Twist_Flag>
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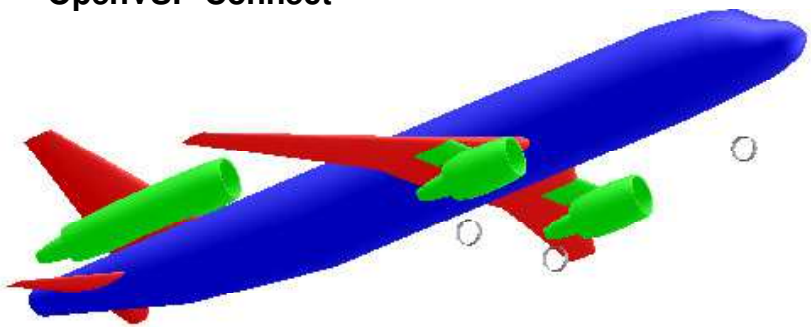
573	Airfoil_List			<Airfoil_List>

OpenVSP-Connect

42	**4.**	**Wing**								
44		**Wing Type**	$Type_w$	Double-trapezoidal	[-]					
45		Total Area	S_w	120,000	[m²]					
46		Total Aspect ratio	A_w	9,480	[-]					
47							Total Span	b_w	33,728	[m]
48		Outboard 25% Sweep	$\Phi_{25,w,o}$	21,881	[°]	<<<<<<	25% Wing sweep suggestion	$\Phi_{25,w,o}$	21,881	[°]
49		Taper Ratio	λ_w	0,198	[-]	<<<<<<	Taper Ratio Suggestion	λ_w	0,198	[-]
50							Root Chord	$c_{r,w}$	5,939	[m]
51							Tip Chord	$c_{t,w}$	1,176	[m]
52							Outboard Leading edge Sweep	$\Phi_{LE,w,o}$	24,334	[°]
53							Outboard Trailing edge sweep	$\Phi_{TE,w,o}$	14,022	[m]
54		Airfoil thickness ratio	(t/c)	0,116	[-]	<<<<<<	Thickness ratio	(t/c)	0,116	[-]
55		X position of wing	$RelPos_{w,x}$	31,500	% of fuselage l	<<<<<<	X position of wing		31,500	% of fuselage length
56		Z position of wing	$RelPos_{w,z}$	25,180	% of fuselage diameter					
57		Outboard dihedral angle	$\Gamma_{w,o}$	2,512	[°]	<<<<<<	Outboard dihedral angle	$\Gamma_{w,o}$	2,512	[°]
58										
59		Edit this section								
60		Relative kink position	$\eta_{k,w}$	0,320	[-]	<<<<<<	Relative kink position	$\eta_{k,w}$	0,320	[-]
61		Inboard Leading edge Sweep	$\Phi_{LE,w,i}$	24,334	[°]	<<<<<<	Inboard Leading edge Sweep	$\Phi_{LE,w,i}$	24,334	[°]
62		Inboard Trailing edge Sweep	$\Phi_{TE,w,i}$	0,000	[°]	<<<<<<	Inboard Trailing edge Sweep	$\Phi_{TE,w,i}$	0,000	[°]
63		Inboard dihedral angle	$\Gamma_{w,i}$	2,512	[°]	<<<<<<	Inboard dihedral angle	$\Gamma_{w,i}$	2,512	[°]
64										
65	**5.**	**Fuselage**								
66										
67		Fuselage diameter	d_f	3,950	[m]					
68		Fuselage length	L_f	35,827	[m]	<<<<<<	Fuselage length	L_f	35,827	[m]
69		Nose length	$L_{n,f}$	6,187	[m]	<<<<<<	Nose length	$L_{n,f}$	6,187	[m]
70		Cockpit length	$L_{c,f}$	2,568	[m]	<<<<<<	Cockpit length	$L_{c,f}$	2,568	[m]
71		Fuselage aft length	$L_{at,f}$	13,035	[m]	<<<<<<	Fuselage tail length	$L_{t,f}$	13,035	[m]
72							Cylinder length	$L_{c,f}$	16,604	[m]
73										
74	**6.**	**Horizontal Tail**								

	Slenderness ratio	
	Cockpit length constant	
	Fuselage tailcone constant	

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 ...

1. Action buttons

Open File in OpenVSP	See changes made 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.	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.

Path to OpenVSP EXE	C:
OpenVSP File	C:
Number of changes:	

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.**

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