

Quick tour around ADS

Aircraft Design Process

ADS performs all the tasks of the Conceptual Design and some of the Preliminary design



1/3 Conceptual Design

- Reverse Engineering
- Feasibility Analysis
- Design
- Performance Analysis
- Risk Analysis
- Cost Analysis
- (Optimization)
- Validation
- Reporting
- Export



2/3 Preliminary Design

- Aerodynamics
- Propulsion
- Performance
- Stability
- Systems
- Structure
- Maintenance
- Equipment
- ...



3/3 Detail Design

- Components
- Tooling





Aircraft Design Software

Conceptual Design	Preliminary Design	Detail Design
ADS RDS (Raymer)	ADS AAA (DARCorporation) OpenVSP (NASA) VSAero (NASA) PIANO J2 Aircraft ...	CAD Software

Why ADS ?

Computation

- Accuracy (cf. validation reports)
- Compilation of the best algorithms
- Includes unique modules: reverse engineering, optimization, validation
- Focused on Conceptual Design (the airplane as a whole)

Use/Support

- User friendly application
- Large number of technical notes accessible directly from the software
- Efficient online technical support
- Customized online training
- Spoken languages: French/English

Versions

- Lifetime license
- Driven by the users
- Module-based (customize your own version with exactly what you need, no more)

Costs

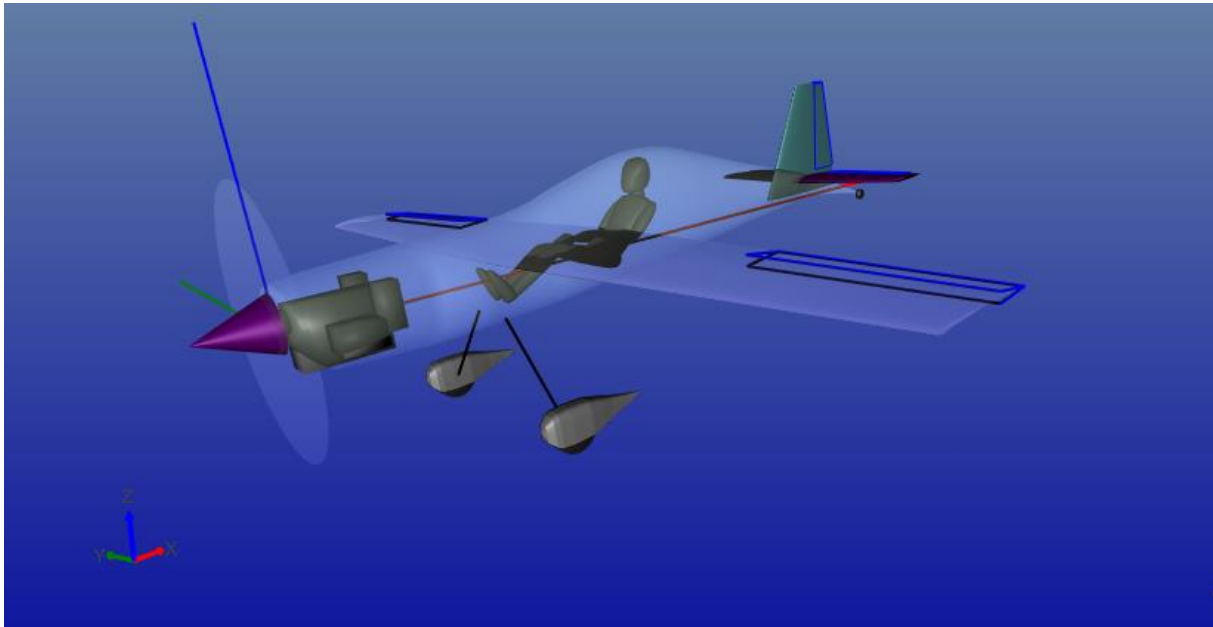
- Affordable
- You pay for what you need (ADS “customized”)
- Reduces drastically the development time and costs

List of the different modules in ADS



RE

Reverse Engineering



Analyze in detail an existing aircraft

→ Aerodynamic efficiency:

- $C_{l_{Mx}}$
- C_{fe}
- C_{d_0}

→ Mass efficiency:

- W_{glider}/W_{MxTO}

Provide priceless information for

→ Engineers:

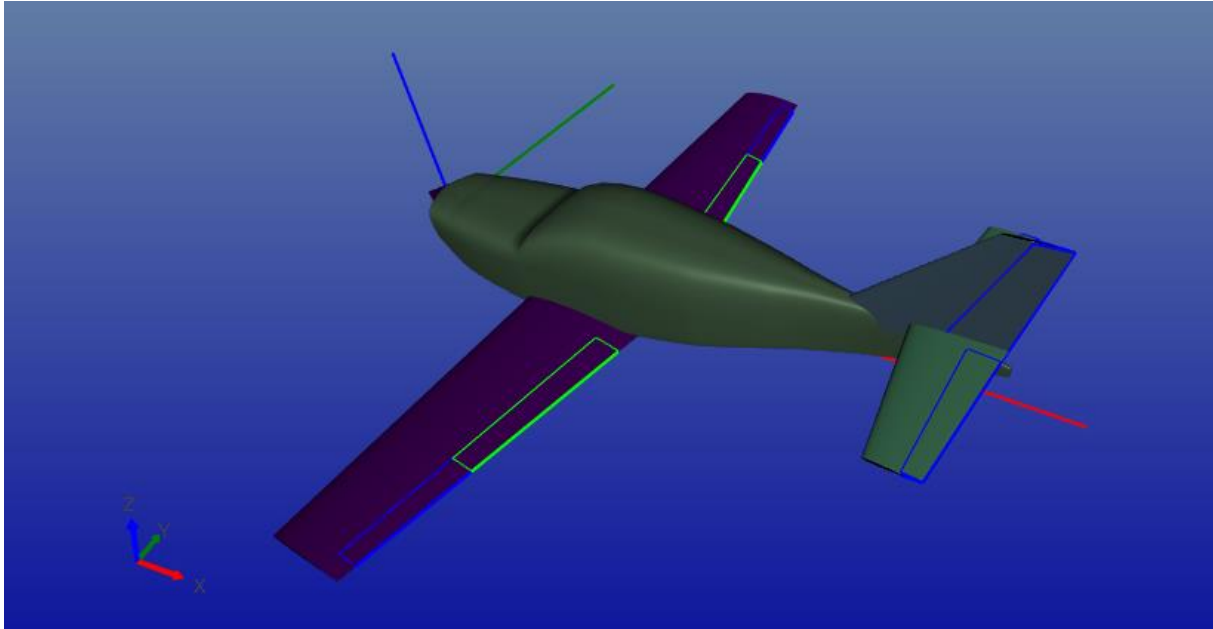
- Acquire orders of magnitude to better start the design
- Acquire orders of magnitude to check the results

→ Salesmen

- Highlight strengths of the new design
- Know the weak points of the competitors

FA

Feasibility Analysis

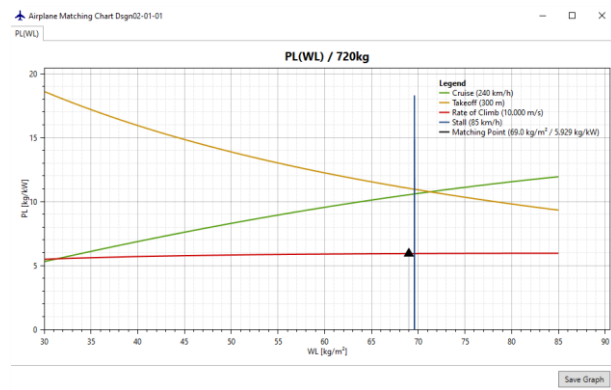


Check the specifications

- ➔ Validate the numbers
- ➔ Adjust the requirements

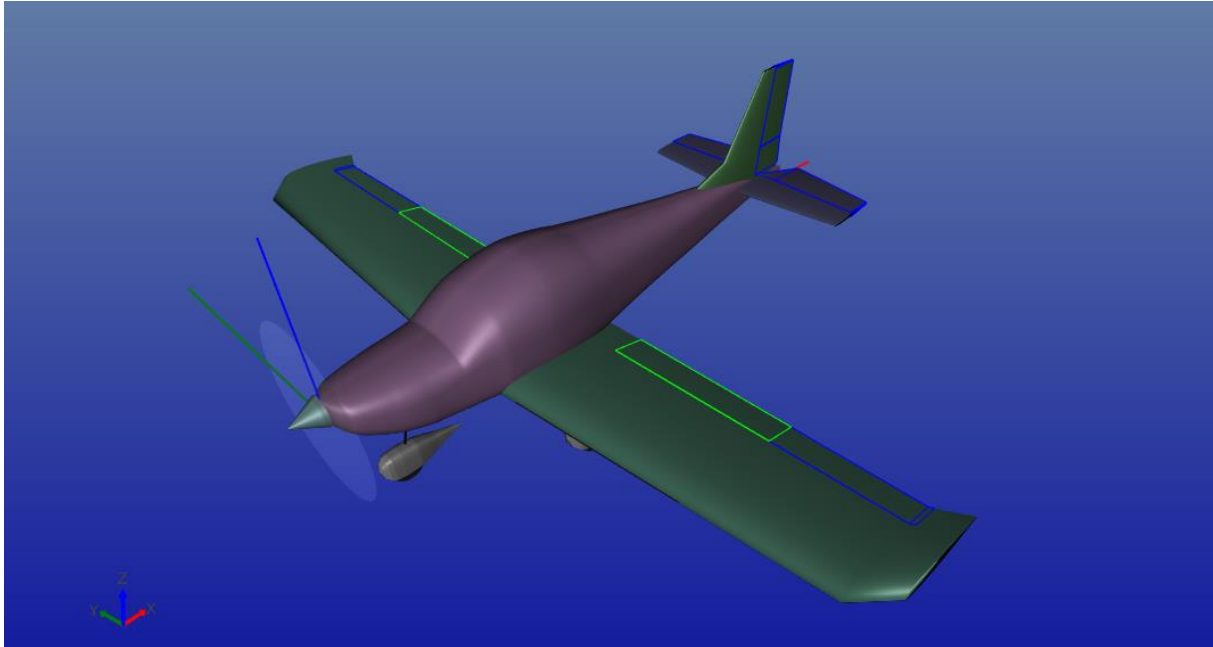
Fix target values for

- ➔ Wing loading
- ➔ Power loading
- ➔ Aerodynamics
- ➔ Mass





Conceptual Design



Reach the **best compromise** to fulfill the requirements

- Configuration
- Geometry
- Powerplant
- Technical choices

Take into account all internal components and structure

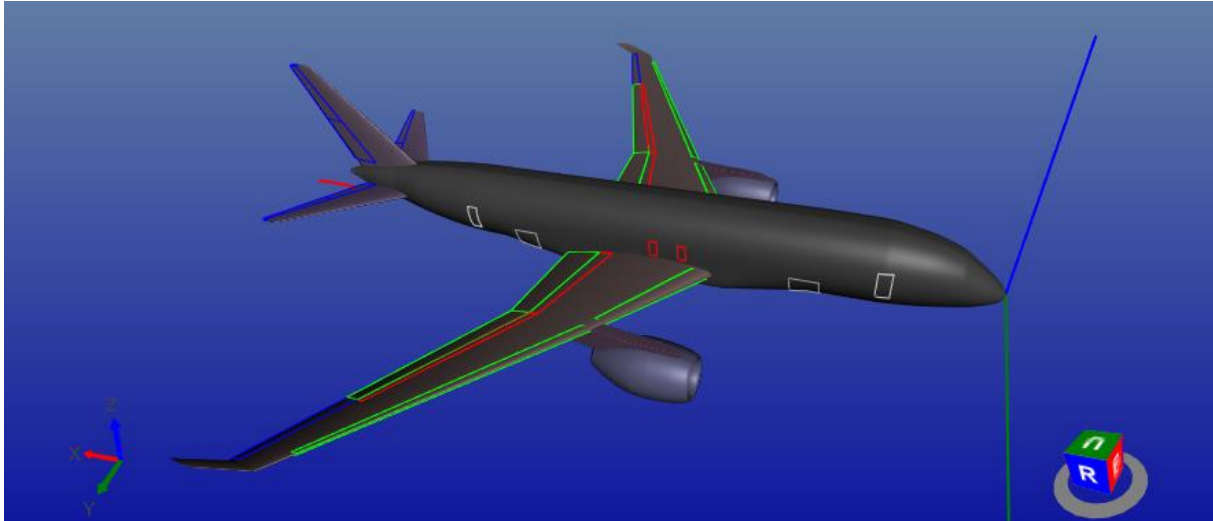
- Avoid interference between components

Analyze

- Performance
- Static and dynamic stability
- Costs

PA

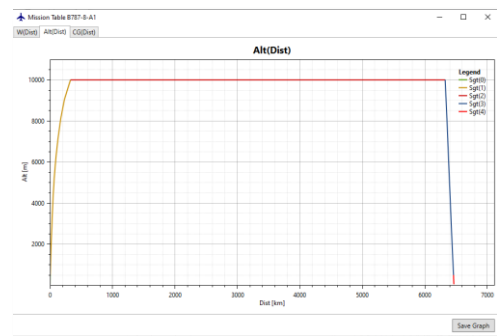
Performance Analysis



1. Compute the performance for different flight conditions
 - ➔ Flight weight
 - ➔ Flight altitude
 - ➔ Power setting
 - ➔ Centre of gravity position

2. Compute the real impact of one modification made on an existing aircraft

3. Anticipate a problem before the problem occurs
 - ➔ Prepare actions
 - ➔ Fix limits





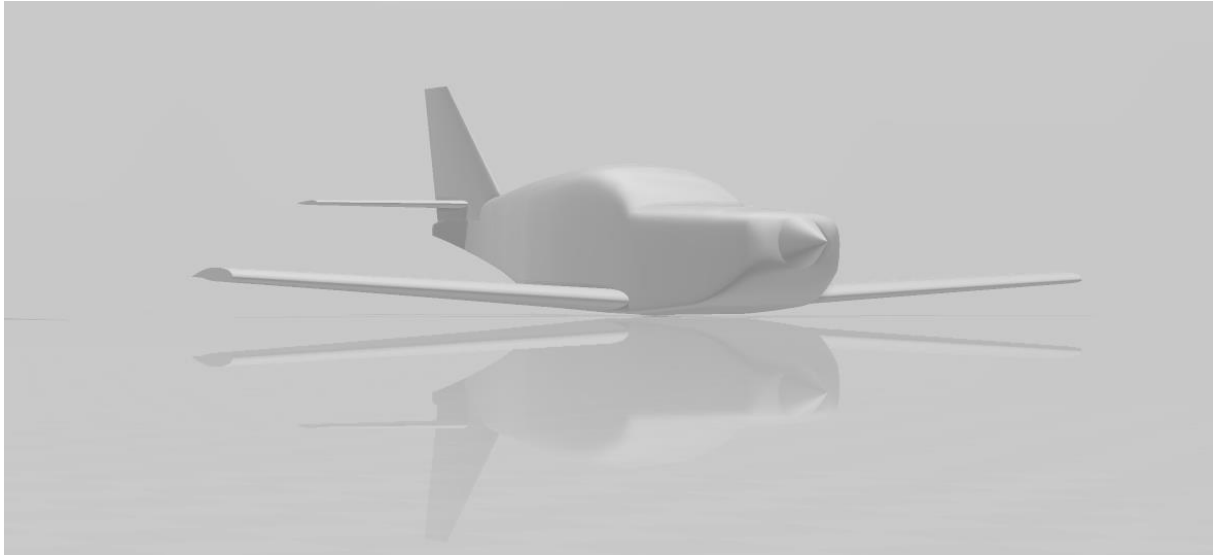
Cost Analysis

More than 90% of the development cost are function of the decisions taken during the Conceptual Design. All the technical choices have an impact on the cost

- Research & Development
- Manufacturing
- Operating
- Market price
- Breakeven Point



Export



The 3D-Model may be exported in stl file format

- ➔ CAD software
- ➔ CFD Analysis
- ➔ 3D-Printers

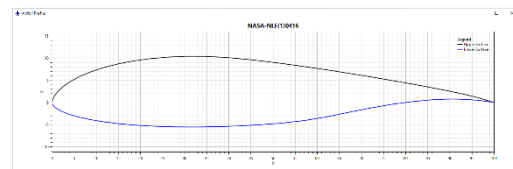
BDF file format is generated in order to perform structural analysis in **Patran/Nastran**

Txt

Reports

CRUISE (70.4%)	
General	
Flight speed @71% power	430 kts
Mach Number	0.38
Ground speed (GS)	430 kts
True Air Speed (TAS)	-
Indicated Air Speed (IAS)	-
Airspeed CO ₂ (%CMA)	-
Wing loading	-
Flight weight	-
Fuel weight (estimated)	-
Payload (estimated)	-
Flight altitude	-
Endurance	-
Fuel Consumption / CO₂ Emission	
Fuel (l/100m)	-
Fuel (l/100m/100kg)	88.4
Fuel (kg/100m)	-
Fuel (kg/100m/100kg)	-
CO ₂ (kg/100m)	-
CO ₂ (kg/100m/100kg)	0.330
Airplane Attitude	
Angle of Attack	-
Flight Path Angle	-
Angle of Pitch	0.574
High Lift Devices	-
Wing trailing edge deflection angle	-
Powerplant	
Power, maximum	186.7
Power, available	-
Power, shaft	-
Power, required	72.9
Engine static power (% nominal power)	-
Specific fuel consumption	15.9
Propeller	
Propeller - rpm	-
Propeller - Pitch angle	7.1
QUALITY	
Symbols	
- Best plane	-
- Worst plane	-
AERODYNAMICS	
Friction coefficient (CF) (-) - Cruise	0.00931
Aerodynamic efficiency (C _L /C _D) (%) - Cruise	0.00435
Aerodynamic efficiency (C _L /C _D) (%) - Cruise	88.4
Flat plate area perpendicular to flow (m ²) - Cruise	0.078
Flat plate width perpendicular to flow (m) - Cruise	0.279
Wing Repe efficiency (%)	72.9
FUEL	
Fuel (l/100m) - Cruise	88.4
Fuel (kg/100m) - Cruise	88.4
Fuel (kg/100m/100kg) - Cruise	88.4
Fuel (kg/100m) - Cruise	88.4
Fuel (kg/100m) - Cruise	88.4

Airfoil Coordinates NASA-NLF(1)0416			
UPPER Surface (%)		LOWER Surface (%)	
X	Y	X	Y
1	0	1	0
2	0.049	2	0.073
3	0.509	3	0.709
4	1.393	4	1.956
5	2.687	5	3.708
6	4.383	6	5.933
7	6.471	7	8.609
8	8.936	8	11.708
9	11.761	9	15.2
10	14.925	10	19.05
11	18.404	11	23.218
12	22.169	12	27.659
13	26.187	13	32.326
14	30.422	14	37.167
15	34.839	15	42.127
16	39.438	16	47.175
17	44.227	17	52.175
18	49.172	18	57.122
19	54.204	19	62.019
20	59.356	20	67.014



Results may be exported in

- ➔ .txt
- ➔ .docx

Tables may be exported in

- ➔ .csv
- ➔ .txt

Graphs may be exported in

- ➔ .bmp
- ➔ .pdf
- ➔ .png
- ➔ .svg



Toolbox...

Mass - Wing - Raymer

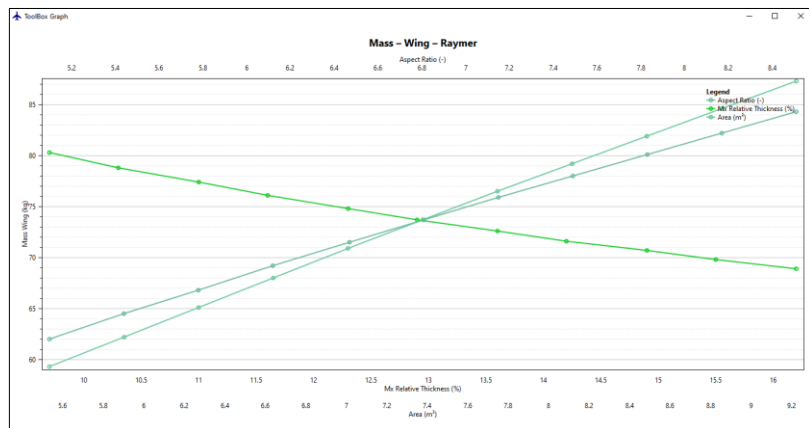
Input: Glasiar-III-0* [Reverse E]

General			
Classification	Light Airplane		
Has Tank	<input checked="" type="checkbox"/>		
Design Limits			
Mx Takeoff Weight	<input type="checkbox"/>	1 134.0	kg
n1	<input type="checkbox"/>	3.80	-
Flight Conditions			
Altitude	<input type="checkbox"/>	2 400	m
Flight Speed	<input type="checkbox"/>	430	km/h
Geometry			
Area	<input checked="" type="checkbox"/>	7.378	m ² 25.0 %
Aspect Ratio	<input checked="" type="checkbox"/>	6.81	- 25.0 %
Mx Relative Thickness	<input checked="" type="checkbox"/>	12.9	% 25.0 %
Sweep @ LE	<input type="checkbox"/>	2.9	*
Tank Volume	<input type="checkbox"/>	300.0	l
Taper Ratio	<input type="checkbox"/>	0.56	-

Output:

Mass

Mass	73.7 kg
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... in which equations are explained graphically.



And in addition

Some database

- Aircraft
- Engine
- Airfoil
- Materials
- Batteries
- Tires
- Fuel
- Regulation

Link with other software

- XFoil
- DFDC

Large number of Technical Notes written to be used during the Conceptual Design

Reference

- Academic & Scientific publications
- USAF DATCOM
- Roskam
- Raymer
- Torenbeek
- ...