



Multi-Disciplinary Conceptual Aircraft Design using CEASIOM

Maria Pester

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Multi-Disciplinary Conceptual Aircraft Design using CEASIOM

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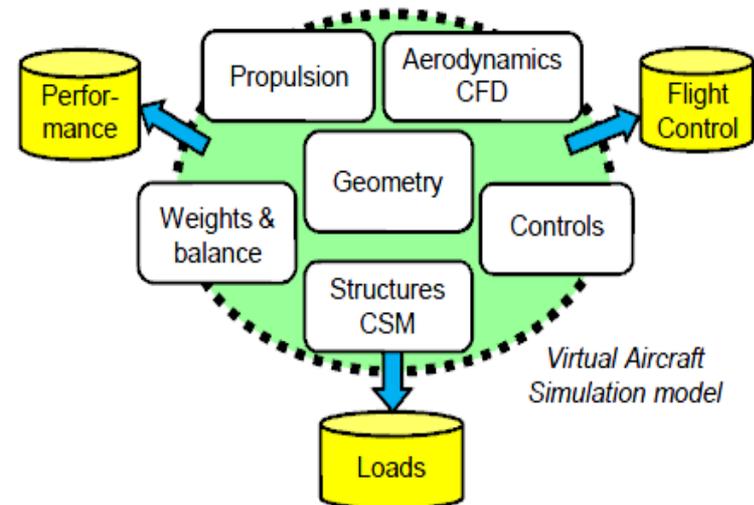
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CEASIOM – a Short Description

- physics based multi-disciplinary program which steps in the conceptual design phase
- aerodynamic and structural requirement can be considered

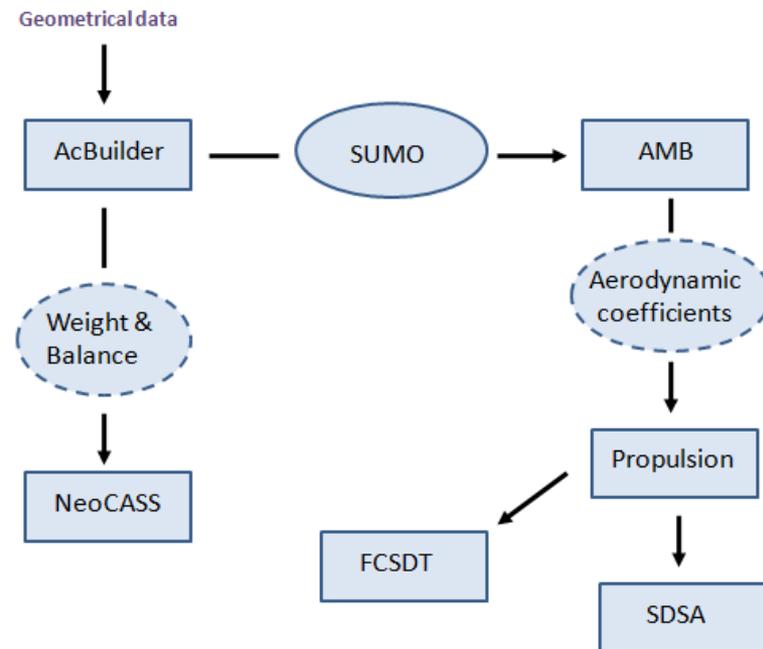


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CEASIOM – a Short Description

- virtual aircraft model is build up
- run through different tools including
 - Geometry
 - Aerodynamic
 - Stability and Control
 - Structure
 - Performance

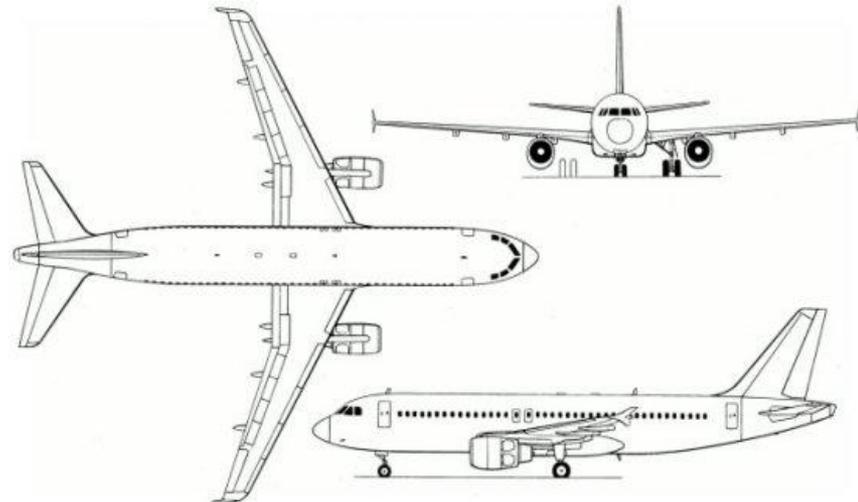


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Reference Aircraft A320

Version	A320-210
MTOW	73 500 kg
MPL	20 000 kg
Range_(MPL)	1 500 NM



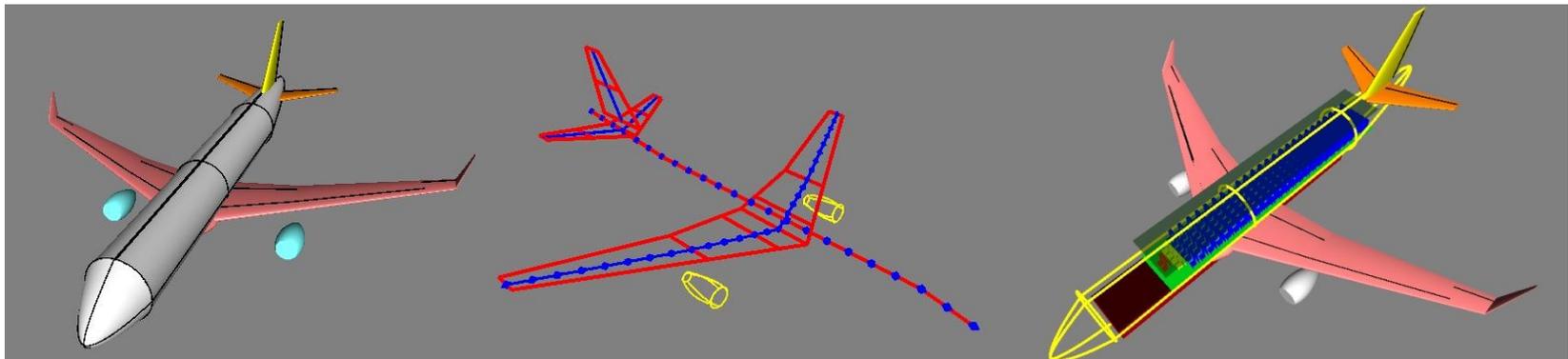
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Tools of CEASIOM Taking the A320 as an Example

AcBuilder

- parametric aircraft builder
- boundary conditions for structure and aerodynamics can be set



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Tools of CEASIOM Taking the A320 as an Example

Weights

	Weights in kg			Comparison in %	
	Airbus	PrADO	V3	V3 - PrADO	V3 - Airbus
MTOW	73500	73500	73397	-0,14	-0,14
OEW	40530	41000	48123	17,37	18,73
max zero fuel weight	60500	60188	63434	5,39	4,85
max. payload	20000	19099	15310	-19,84	-23,45
GMEW		36230	40987	13,13	
Landing gear	2347	2547	3116	22,34	32,76
Wing weight	6279	8297	8766	5,65	40,61
HT weight	670	590	844	43,05	25,97
VT weight	464	434	490	12,90	5,60
Fuselage weight	9267	9119	7207	-20,97	-22,23
Engine group		7822	9235	18,06	
fuel	12500	13312	9963	-25,16	-20,30
Strong deviation					

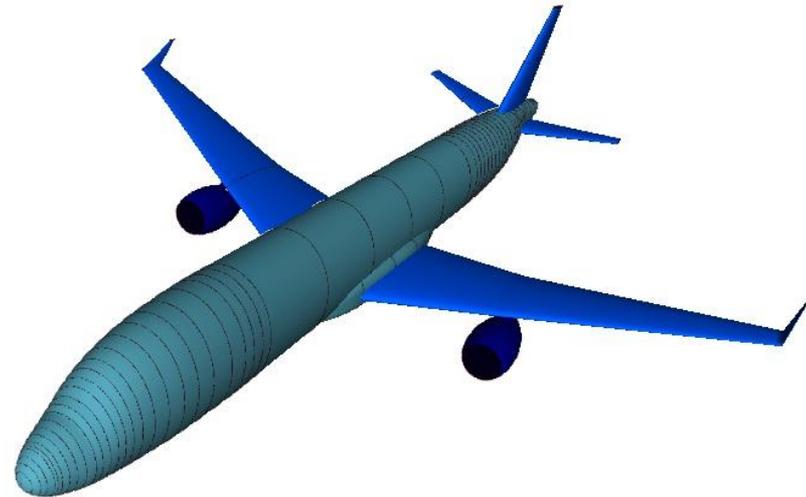
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Tools of CEASIOM Taking the A320 as an Example

SUMO

- CAD modelling
- 3D mesh generator



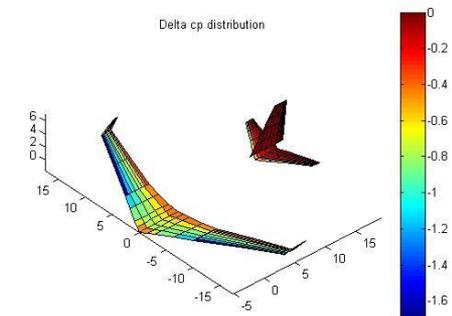
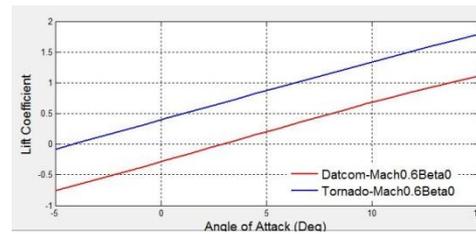
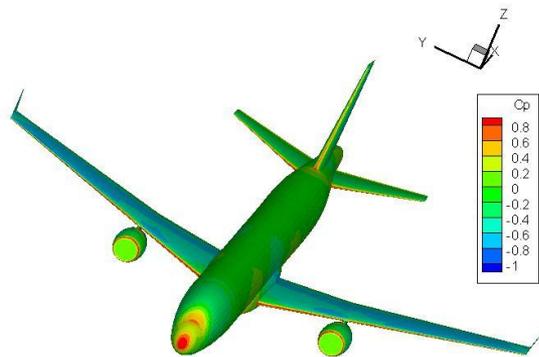
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Tools of CEASIOM Taking the A320 as an Example

AMB

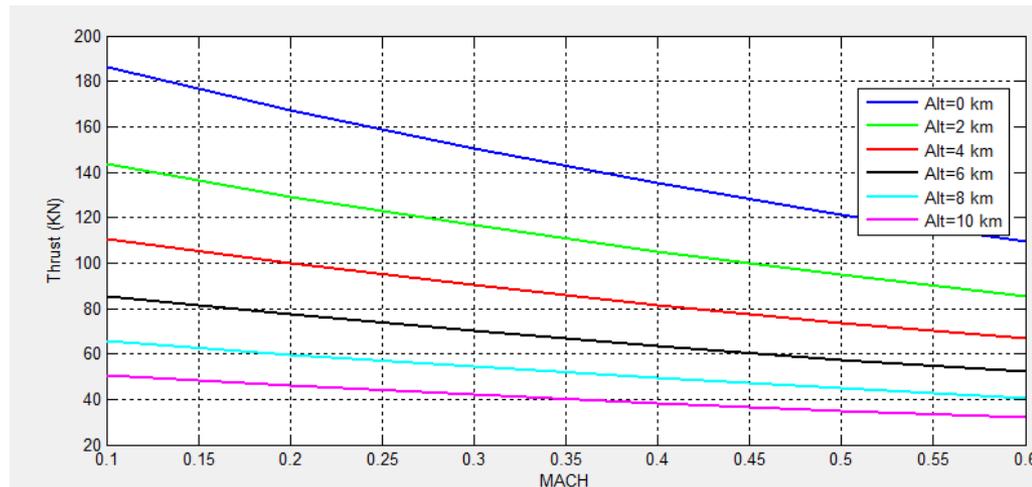
- aerodynamic model builder
- aerodynamic coefficients can be calculated on different ways – DATCOM, Tornado, EDGE EULER



Tools of CEASIOM Taking the A320 as an Example

Propulsion

- generates the database of the engines for following calculations





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Tools of CEASIOM Taking the A320 as an Example

SDSA

- tool for stability and control, performance and simulation
- stability analyses based on JAR/FAR, ICAO



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Tools of CEASIOM Taking the A320 as an Example

- Simulation

The screenshot displays the CEASIOM simulation environment. On the left, a control panel includes a 'Simulation commands' section with buttons for Start, Run, Stop, and Pause, each with a corresponding status indicator. Below this is the 'Initial conditions' section, where 'Altitude AGL [m]' is set to 10000 and 'Airspeed [m/s]' is set to 230. The 'Airspeed type' is set to TAS. At the bottom left, there are 'Control' panels for 'Stick pitch', 'Stick roll', and 'Pedals', along with a 'Throttle [%]' slider and an 'LQR' control panel. The central part of the interface shows a 3D model of an A320 aircraft in a light blue color. To the right of the aircraft is an 'Attitude' gauge showing pitch and roll. On the far right, a 'Results of simulation' panel displays various parameters: Altitude AGL [m]: 10000.00, Ground Speed [km/h]: 0.000, Vertical velocity [m/s]: 0.000, Horizontal velocity [m/s]: 230.000, Airspeed [m/s]: 230.000, IAS [m/s]: 0.000, Mach number: 0.779, Angle of attack [deg]: 0.000, Sideslip angle [deg]: 0.000, Heading [deg]: 0.000, Velocity course [deg]: 0.000, Path angle [deg]: 0.000, and Max. performed Gz: 1.00. A 'More results ...' button is located at the bottom of the results panel.

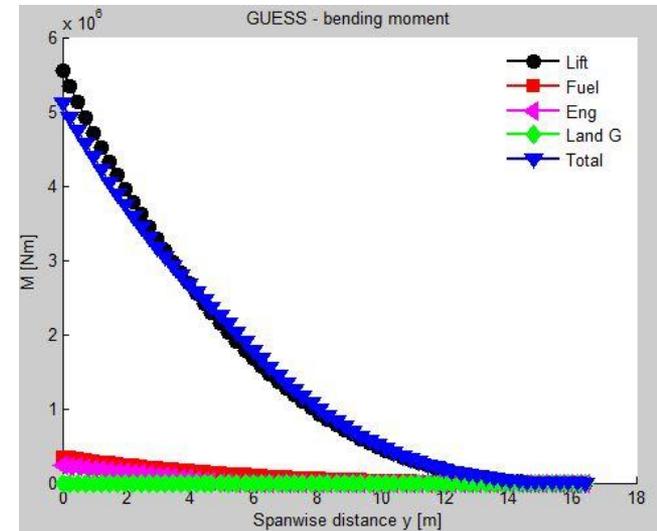
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Tools of CEASIOM Taking the A320 as an Example

NeoCASS – GUESS

- main components are loads and sizing
- represents a compromise between empirical and finite element methods



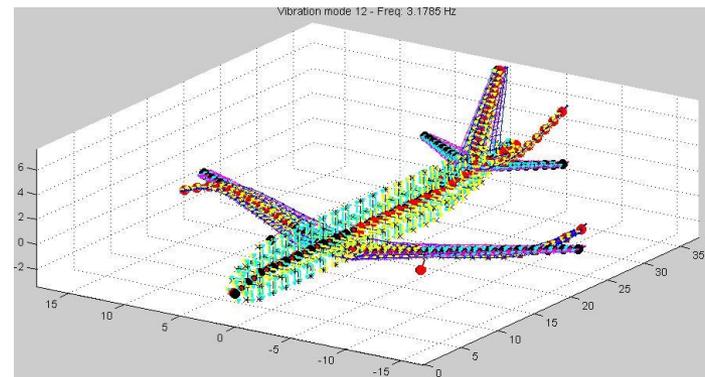
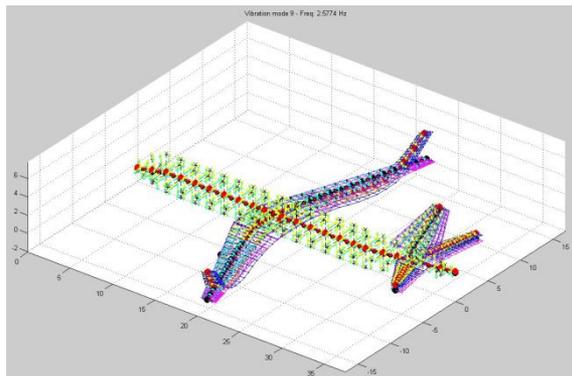
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Tools of CEASIOM Taking the A320 as an Example

NeoCASS – SMARTCAD

- contains numeric aero-structural analysis based on simplified models
- an example: flutter analysis





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Tools of CEASIOM Taking the A320 as an Example

FCSDT

- **Flight Control System Designer Toolkit**
- **flight control system architecture can be defined**
- **following features are not ready to use**

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Concept of a Shoulder Wing Aircraft

Idea

- better ground handling → time saving of several minutes

→ smaller cruise speed

→ fuel saving

→ cost saving

	typical flight missions
A	8 x 1,5 hours
B	2 x 4,5 hours, 2 x 1,5 hours
C	3 x 4,5 hours
D	1 x 5 hours, 1 x 1,5 hours
E	1 x 5 hours, 1 x 1 hours

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Concept of a Shoulder Wing Aircraft

- **Comparison with the A320**

Components	A320 SW PreSTO	A320 – 210
propulsion	turboprop	Jet CFM56
number of engines	2	2
Wing location	shoulder wing aircraft	Low wing aircraft
Wing geometry	swept taper wing Sw= 98,4 m ²	Swept tapered wing Sw = 122,4 m ²
Mach cruise	0,69	0,76
Cruise altitude	9 881 m	11 800 m
Landing field length	1 700 m	1 700 m
Take off field length	2 200 m	2 200 m
Range at max. Payload	1 500 NM	1 500 NM
MTOW	69 000 kg	73 500 kg
Max.Payload	20 000 kg	20 000 kg
Number of Passanger	150	150
fuel weight	11 975 kg	12 500 kg

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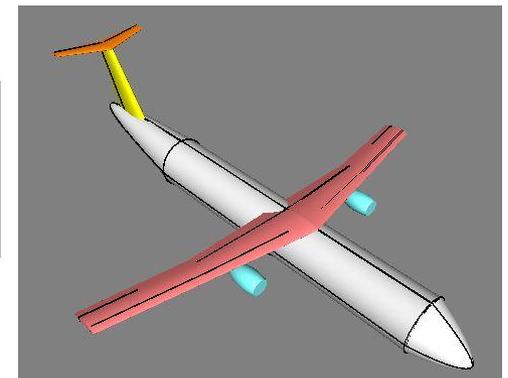
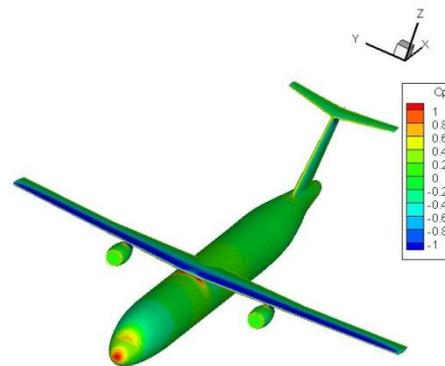
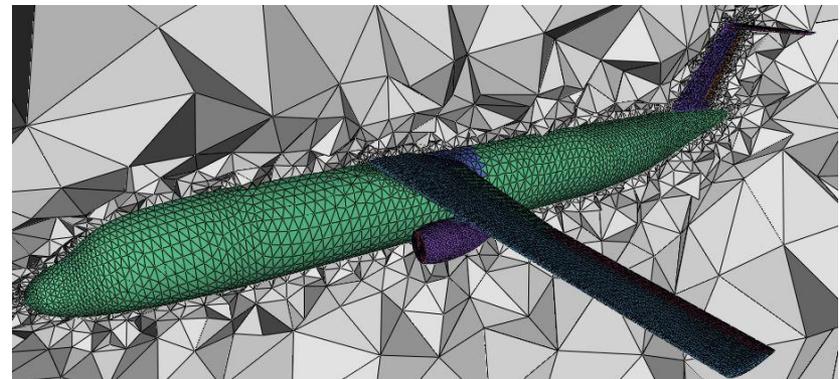
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Shoulder Wing Aircraft in CAESIOM

- model of the shoulder wing aircraft could be implemented into

- AcBuilder
- AMB
- SDSA
- NeoCASS

- weak point of the first implementation can be shown



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Conclusion and Outlooks

- **The development of CEASIOM is still in process**
- **Many problems appear during the work with CEASIOM**
- **As soon the weak points are repaired CEASIOM will become a readily accessible and also timesaving tool for the conceptual design phase**

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Questions

Many thanks for your attention!

Are there any questions?