

C-130

Flight Simulation Data

Zielonka 2019

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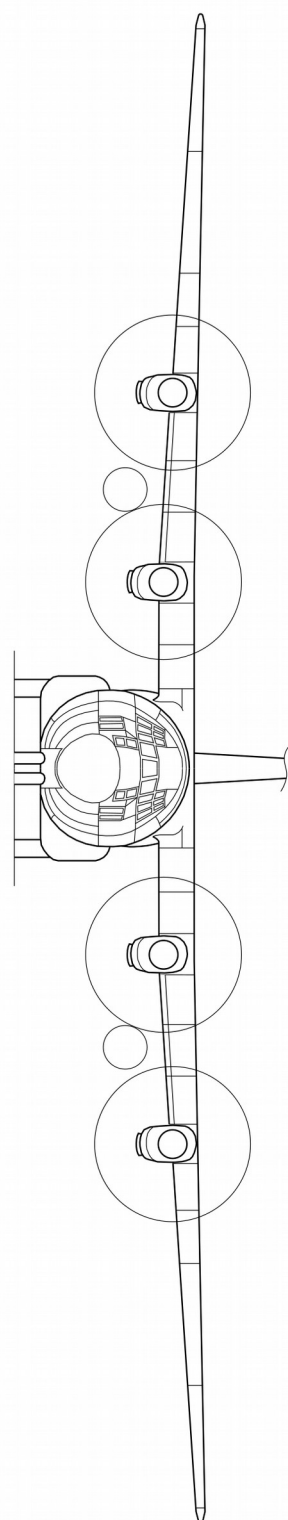
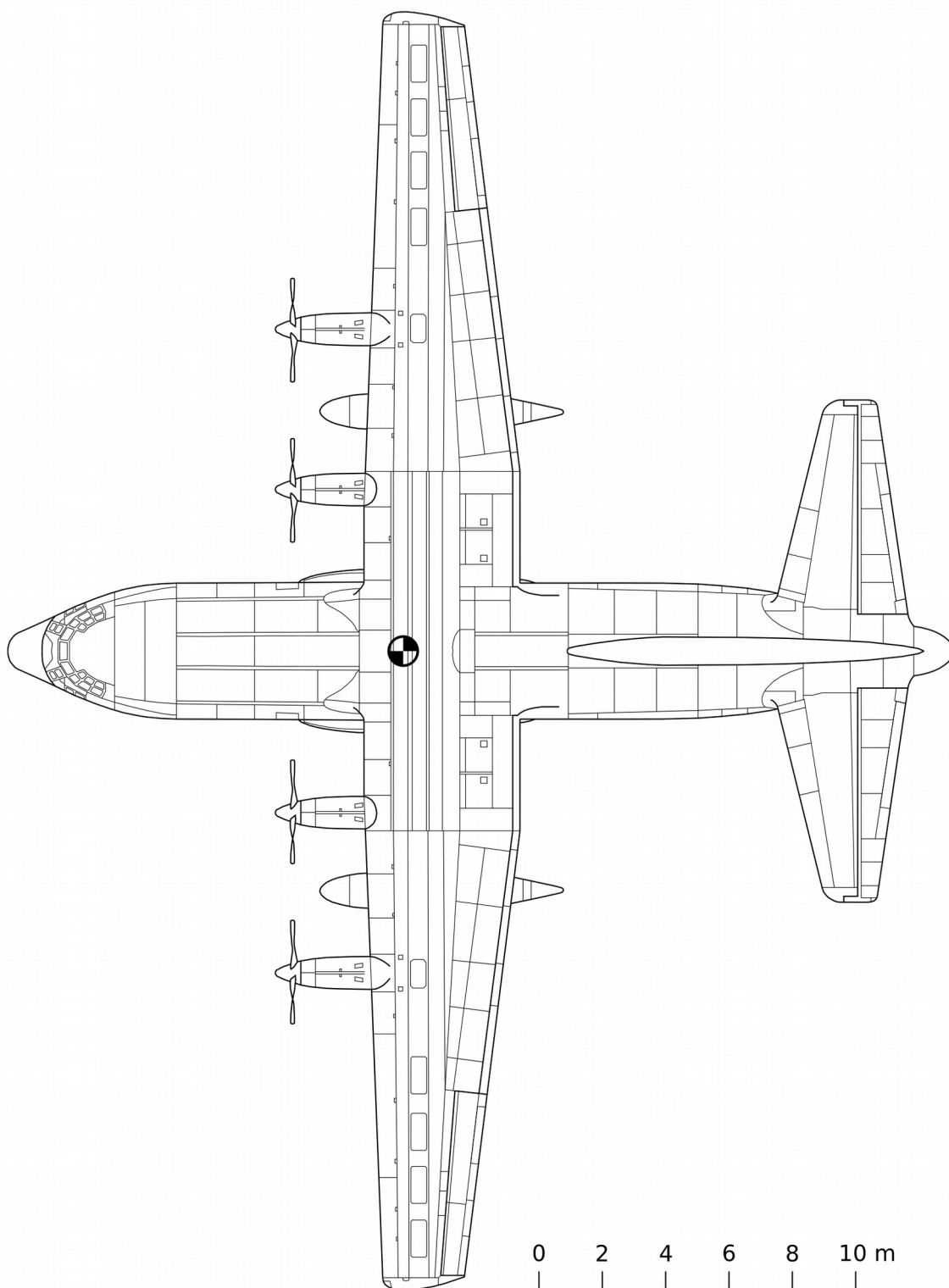
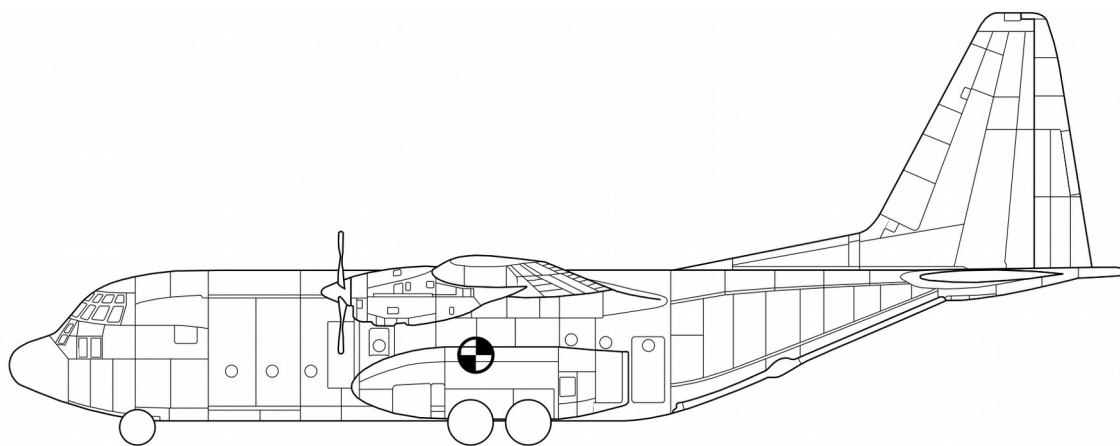
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1. General Data

Parameter	Value	Reference
Length	30.30 m	[1]
Wingspan	40.41 m	[1], [2], [3], [4]
Height	11.68 m	[1]
Wheelbase	9.77 m	[5]
Wheel track	4.34 m	[3], [4]
Wing area	162.12 m ²	[4], [5]
Mean aerodynamic chord	4.16 m	[5]
Wing dihedral	2.5°	[3], [4]
Wing incidence (at root)	3°	[4]
Wing incidence (at tip)	0°	[4]
Wing airfoil (at root)	NACA 64A318	[4]
Wing airfoil (at tip)	NACA 64A412	[4]
Wing aspect ratio	10.09	[5]
Horizontal tail span	16.05 m	[1], [2], [3], [5]
Horizontal tail area	35.40 m ²	[4], [5]
Horizontal tail airfoil	NACA 23012	[6]
Vertical tail area	20.90 m ²	[4], [5]
Vertical tail airfoil	NACA 64A016	[6]
Ailerons deflection limit (normal)	up 30°, down 19°	[6]
Ailerons deflection limit (drooped)	up 30°, down 60°	[6]
Ailerons area (total)	10.22 m ²	[4], [5]
Elevator deflection limit	up 49°, down 38.5°	[6]
Elevator area (including trim tab)	14.40 m ²	[4], [5]
Rudder deflection limit	±60°	[6]
Rudder area (including trim tab)	6.97 m ²	[4], [5]
Flaps area	31.77 m ²	[4], [5]
Flaps deflection limit	35°	[1], [2], [3]
Operating weight empty	34 686 kg	[5]
Max fuel weight (internal, JP-5/JP-8)	20 819 kg	[4]
Max fuel weight (external, JP-5/JP-8)	8 506 lg	[4]

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Parameter	Value	Reference
Max payload	19 356 kg	[5]
Engine manufacturer	Allison	[1], [3]
Engine model	T56-A-15	[2], [3]
Engine takeoff power (at 100% or 13 820 propeller RPM)	3 663 kW	[2], [3]
Engine height	0.991 m	[5]
Engine width	0.686 m	[5]
Engine length	3.708 m	[5]
Engine standard dry weight	828 kg	[5]
Specific fuel consumption	304.8 g/(kW·h)	[5]
Propeller manufacturer	Hamilton Standard	[1], [3]
Propeller model	54H60-117	[3]
Number of blades	4	[3]
Propeller diameter	4.11 m	[3], [5]

2. Performance

Parameter	Value	Reference
Never exceed speed	378 kts	[4]
Max cruising speed (at maximum TO weight)	325 kts	[5]
Stalling speed (at maximum TO weight)	100 kts	[4], [5]
Max rate of climb (at SL, maximum TO weight)	1 900 ft/min	[5]
Service ceiling (at 58 970 kg AUW)	26 500 ft	[5]
Maximum takeoff weight (normal)	70 310 kg	[2], [5]
Takeoff run (at maximum TO weight)	1 091 m	[5]
Takeoff to 15 m (at maximum TO weight)	1 573 m	[5]
Landing from 15 m (at 58 967 kg AUW)	838 m	[5]
Landing run (at 58 967 kg AUW)	518 m	[5]
Range (with max payload, 5% reserves)	2 046 nmi	[5]

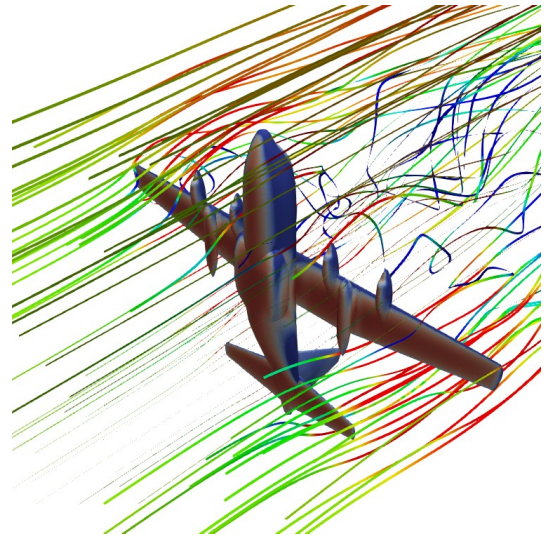
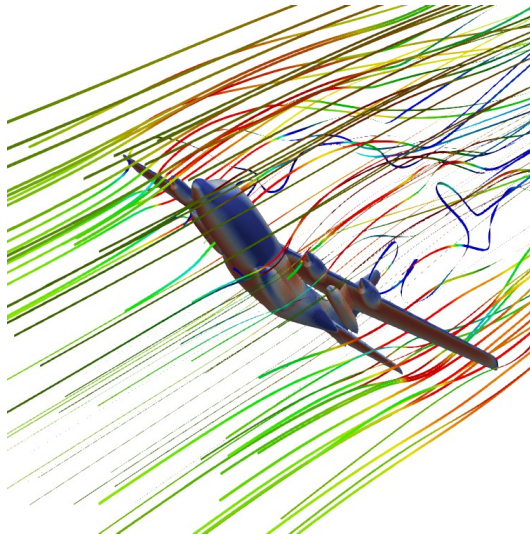
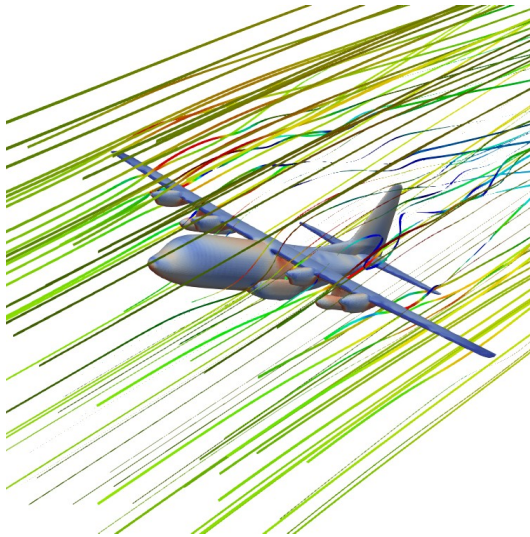
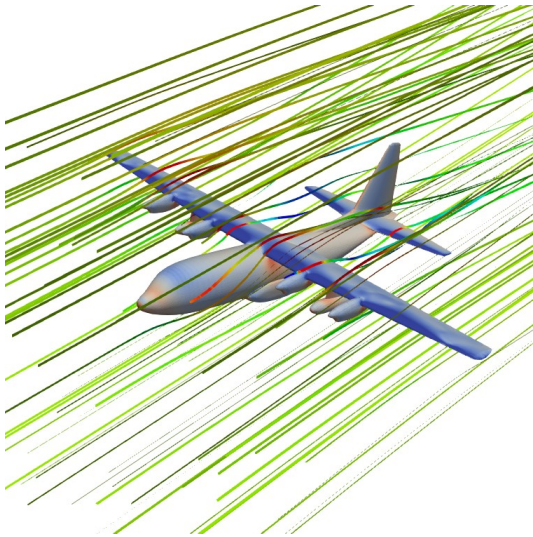
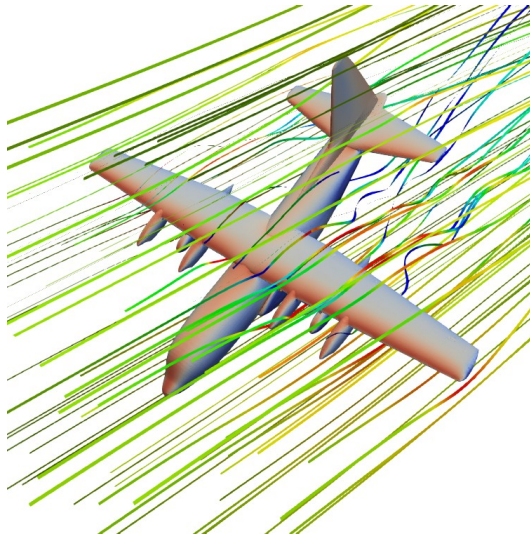
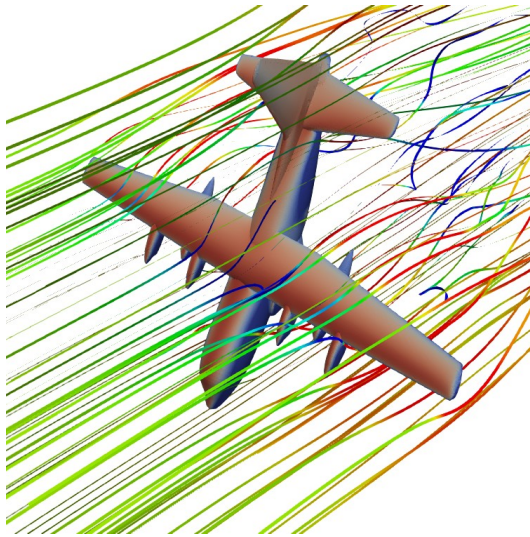
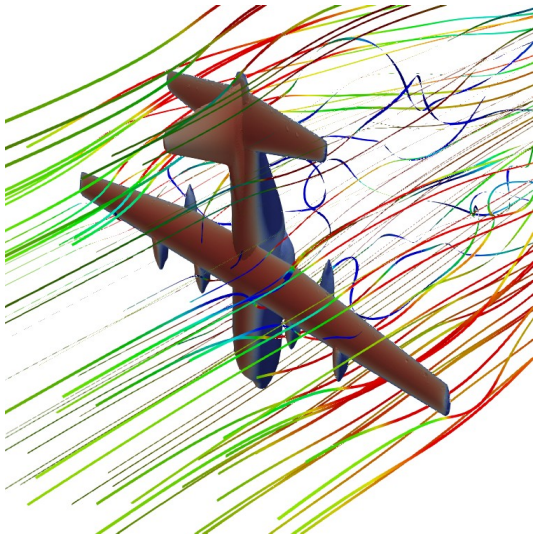
3. Geometric Parameters

3.1. Wing Aerodynamic Center

Position of wing aerodynamic center is at 25% of the mean aerodynamic chord and its lateral coordinate is given by the following formula. [7], [8]

$$y_{AC} = \frac{b(1+2\lambda)}{6(1+\lambda)} = 9.05 \text{ m} \quad (3.1)$$

4. Aerodynamic Characteristics



Streamlines and kinematic pressure distribution for various angles of attack

5. Mass Data

Data given in [8], data from chapter 1. and coordinates of structure groups estimated using aircraft drawing were used to calculate empty aircraft inertia tensor and center of mass coordinates. Results are given in the following table.

Parameter	Value
Center of mass x-coordinate	-0.32 m
Center of mass y-coordinate	0.00 m
Center of mass z-coordinate	-0.86 m
Moment of inertia I_x	1 737 837.0 kg·m ²
Moment of inertia I_y	1 595 419.0 kg·m ²
Moment of inertia I_z	3 167 385.7 kg·m ²
Cross product of inertia I_{xy}	0.0 kg·m ²
Cross product of inertia I_{xz}	-112 049.1 kg·m ²
Cross product of inertia I_{yz}	0.0 kg·m ²

Empty aircraft inertia tensor and center of mass coordinates

Structure group	Weight [kg]	Coordinates [m]			First moment of mass [kg·m]			Moment of inertia [kg·m ²]			Moment of inertia (Body Axis System) [kg·m ²]					
		x	y	z	S_X	S_Y	S_Z	$I_{x,0}$	$I_{y,0}$	$I_{z,0}$	I_x	I_y	I_z	I_{xy}	I_{xz}	I_{yz}
Wing	9366.6	0.00	0.00	-1.30	0.0	0.0	-12176.5	1275731.3	14631.8	1288115.1	1291560.8	30461.3	1288115.1	0.0	0.0	0.0
Tail	2742.6	-13.98	0.00	-3.38	-38341.9	0.0	-9270.1	0.0	0.0	0.0	31332.8	567352.1	536019.2	0.0	-129595.5	0.0
Fuselage	11483.0	1.61	0.00	-0.32	18487.6	0.0	-3674.6	33080.6	893921.4	896227.5	34256.5	924862.3	925992.5	0.0	5916.0	0.0
Landing gear	4276.9	0.10	0.00	0.90	427.7	0.0	3849.2	8597.2	39516.9	47070.4	12061.4	43024.0	47113.2	0.0	-384.9	0.0
Surface controls	1362.9	0.60	0.00	0.06	817.7	0.0	81.8	163.5	163.5	0.0	168.5	659.1	490.6	0.0	-49.1	0.0
Nacelle 1	535.5	1.40	-10.21	-1.58	749.7	-5467.6	-846.1	66.5	689.0	666.3	57227.3	3075.5	57539.8	7654.6	1184.6	-8638.8
Nacelle 2	535.5	1.40	-5.07	-1.58	749.7	-2715.0	-846.1	0.0	0.0	0.0	15102.1	2386.5	14814.9	3801.1	1184.6	-4289.8
Nacelle 3	535.5	1.40	10.21	-1.58	749.7	5467.6	-846.1	0.0	0.0	0.0	57160.8	2386.5	56873.6	-7654.6	1184.6	8638.8
Nacelle 4	535.5	1.40	5.07	-1.58	749.7	2715.0	-846.1	0.0	0.0	0.0	15102.1	2386.5	14814.9	-3801.1	1184.6	4289.8
Engine 1	828.0	1.40	-10.21	-1.58	1159.2	-8453.9	-1308.2	100.2	1016.5	981.2	88481.4	4706.4	88918.2	11835.4	1831.5	-13357.1
Engine 2	828.0	1.40	-5.07	-1.58	1159.2	-4198.0	-1308.2	100.2	1016.5	981.2	23450.9	4706.4	23887.7	5877.1	1831.5	-6632.8
Engine 3	828.0	1.40	10.21	-1.58	1159.2	8453.9	-1308.2	100.2	1016.5	981.2	88481.4	4706.4	88918.2	-11835.4	1831.5	13357.1
Engine 4	828.0	1.40	5.07	-1.58	1159.2	4198.0	-1308.2	100.2	1016.5	981.2	23450.9	4706.4	23887.7	-5877.1	1831.5	6632.8

Structure groups breakdown

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