# C-130

# Flight Simulation Data

Zielonka 2019

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Revision: 1

Date: 2019-12-08

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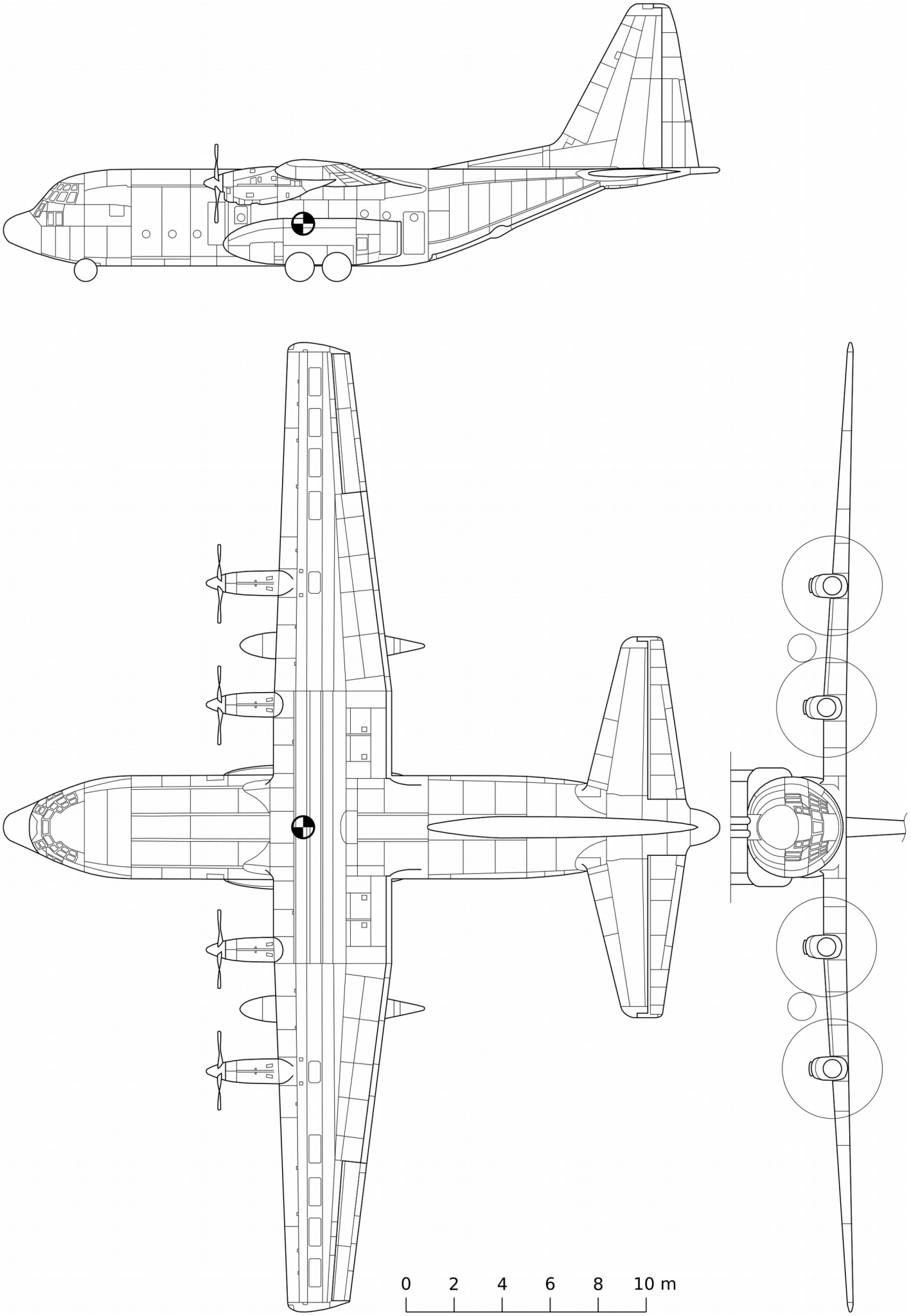
# Table of Contents


0 2 4 6 8 10 m

# 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] |

| Parameter | Value | Reference |
|---|---|---|
| Unusable fuel | 225 kg | [1] |
| 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 T-O weight) | 325 kts | [5] |
| Stalling speed (at maximum T-O weight) | 100 kts | [4], [5] |
| Max rate of climb (at SL, maximum T-O weight) | 1 900 ft/min | [5] |
| Service ceiling (at 58 970 kg AUW) | 26 500 ft | [5] |
| Maximum take-off weight (normal) | 70 310 kg | [2], [5] |
| Maximum payload | 19 356 kg | [5] |
| Take-off run (at maximum T-O weight) | 1 091 m | [5] |
| Take-off to 15 m (at maximum T-O 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] |

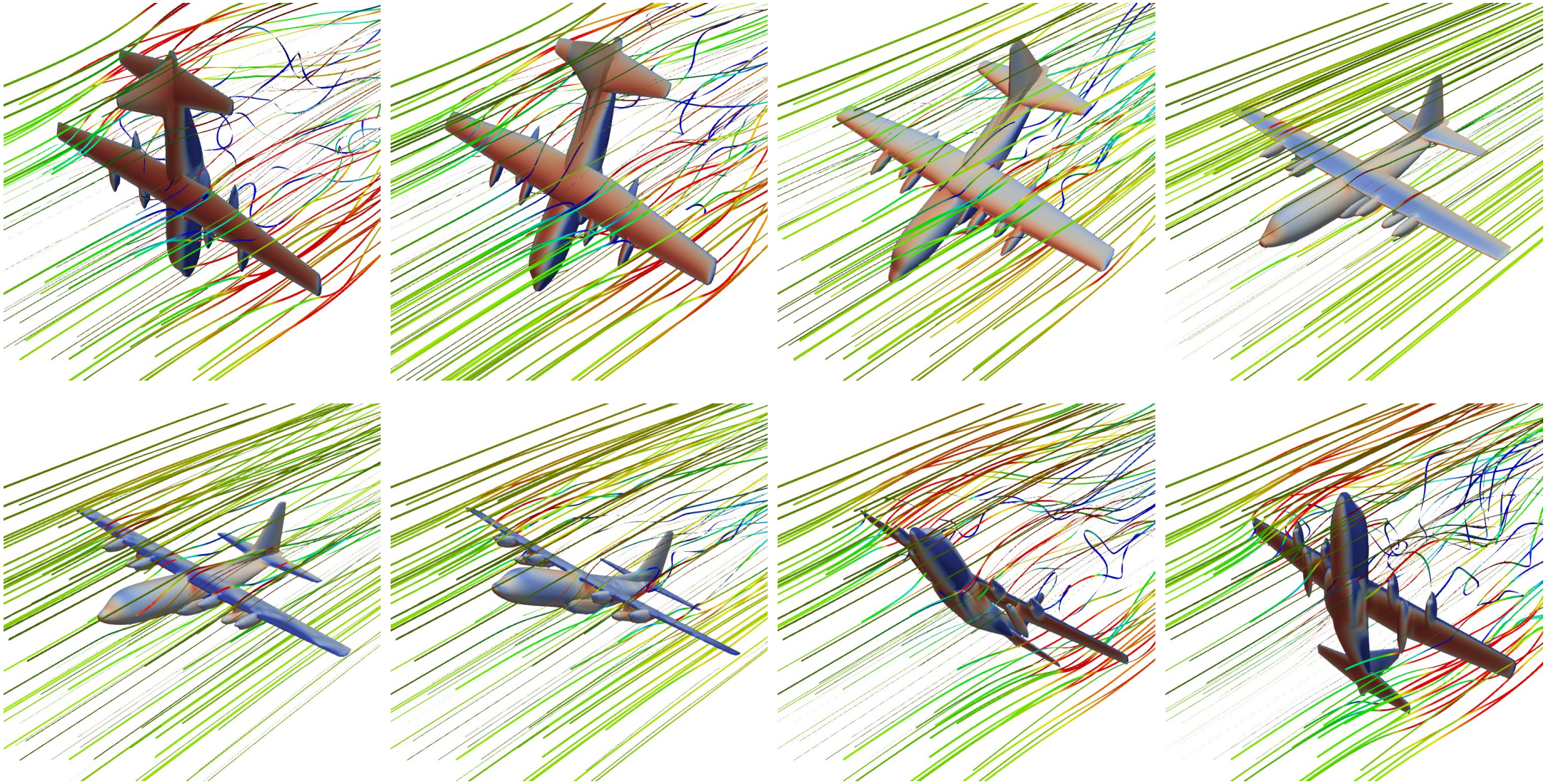
# 3. Geometric Parameters

## 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]

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

# 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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