

## Airbus Cargo Drone Challenge Frame Sheet

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Green cells are calculated by formulas or are given (not changeable) requirement values

White cells are specific to the design entry; mandatory to be filled out by the participant as delivery item

Blue cells are optional delivery items

### Aircraft Data:

Aircraft name : Allodola 100 km 3kg

### General Requirements

Description	Symbol	Value	Unit	Comment
Maximum Take-Off Mass	mMTOM =	<span style="background-color: #90EE90; border: 1px solid black; padding: 2px;">25,0</span>	kg	Shall stay below 25 kg
Air Density	r =	<span style="background-color: #90EE90; border: 1px solid black; padding: 2px;">0,954</span>	kg/m <sup>3</sup>	@ 2000m MSL and ISA+20°C

### Geometry Data:

Description	Symbol	Value	Unit	Comment
Wing Span	b =	<span style="background-color: #90EE90; border: 1px solid black; padding: 2px;">4,0945</span>	m	
Aspect Ratio	AR =	<span style="background-color: #90EE90; border: 1px solid black; padding: 2px;">19,5940458</span>		
Wing Area	Sref =	<span style="background-color: #90EE90; border: 1px solid black; padding: 2px;">0,85561351</span>	m <sup>2</sup>	
Wing Loading (fixed wing mode)	m/Sref =	<span style="background-color: #90EE90; border: 1px solid black; padding: 2px;">29,2188</span>	kg/m <sup>2</sup>	10 - 30 kg/m <sup>2</sup> recommendation
Disc Loading (rotor disc)	m/Sprop Lift =	<span style="background-color: #90EE90; border: 1px solid black; padding: 2px;">13</span>	kg/m <sup>2</sup>	10 - 50 kg/m <sup>2</sup> recommendation
Lift Propeller Area per Lift Propeller	Sprop Lift =	<span style="background-color: #90EE90; border: 1px solid black; padding: 2px;">0,481</span>	m <sup>2</sup>	
Lift Propeller Diameter	Dprop Lift =	<span style="background-color: #90EE90; border: 1px solid black; padding: 2px;">0,782</span>	m	
Cruise Propeller Diameter	Dprop Cruise =	<span style="background-color: #90EE90; border: 1px solid black; padding: 2px;">0,47</span>	m	
Cruise Propeller Area per Cruise Propeller	Sprop Cruise =	<span style="background-color: #90EE90; border: 1px solid black; padding: 2px;">0,35</span>	m <sup>2</sup>	
Number of Propeller for Hover	npropeller,hover =	<span style="background-color: #90EE90; border: 1px solid black; padding: 2px;">4</span>		
Number of Propeller for Cruise	npropeller,cruise =	<span style="background-color: #90EE90; border: 1px solid black; padding: 2px;">2</span>		
Fuselage Length	Lfuselage =	<span style="background-color: #90EE90; border: 1px solid black; padding: 2px;">1,8</span>	m	
Fuselage Diameter (max. Diameter)	Dfuselage =	<span style="background-color: #90EE90; border: 1px solid black; padding: 2px;">0,8</span>	m	
Vertical Tail Surface	Svertical tail =	<span style="background-color: #ADD8E6; border: 1px solid black; padding: 2px;">0,169</span>	m <sup>2</sup>	
Vertical Tail Leaver Arm to CoG	lvertical tail =	<span style="background-color: #ADD8E6; border: 1px solid black; padding: 2px;">1,386</span>	m	
Horizontal Tail/Canard Surface	Shorizontal tail =	<span style="background-color: #ADD8E6; border: 1px solid black; padding: 2px;"></span>	m <sup>2</sup>	
Horizontal Tail/Canard Leaver Arm to CoG	lhorizontal tail =	<span style="background-color: #ADD8E6; border: 1px solid black; padding: 2px;"></span>	m	
Control Surface Area for Pitch	Scontrol,pitch =	<span style="background-color: #ADD8E6; border: 1px solid black; padding: 2px;">0,069</span>	m <sup>2</sup>	
Control Surface Leaver Arm to CoG for Pitch	lcontrol,pitch =	<span style="background-color: #ADD8E6; border: 1px solid black; padding: 2px;">1,386</span>	m	
Control Surface Area for Roll	Scontrol,roll =	<span style="background-color: #ADD8E6; border: 1px solid black; padding: 2px;">0,042</span>	m <sup>2</sup>	
Control Surface Leaver Arm to CoG for Roll	lcontrol,roll =	<span style="background-color: #ADD8E6; border: 1px solid black; padding: 2px;">0,997</span>	m	
Control Surface Area for Yaw	Scontrol,yaw =	<span style="background-color: #ADD8E6; border: 1px solid black; padding: 2px;">0,069</span>	m <sup>2</sup>	
Control Surface Leaver Arm to CoG for Yaw	lcontrol,yaw =	<span style="background-color: #ADD8E6; border: 1px solid black; padding: 2px;">1,386</span>	m	

### Mass and Balance Data:

Description	Symbol	Value	Unit	Comment
Structural Mass (wing, fuselage, empennage, nacelles, ...)	mstruct =	<span style="background-color: #90EE90; border: 1px solid black; padding: 2px;">5,3</span>	kg	
Avionics Mass (see ignition kit)	mavionics =	<span style="background-color: #90EE90; border: 1px solid black; padding: 2px;">3,4</span>	kg	
Flight Control Actuation	mactuation =	<span style="background-color: #90EE90; border: 1px solid black; padding: 2px;">2</span>	kg	
Electric Motors and Controllers Mass (for hover)	mmotors,hover =	<span style="background-color: #90EE90; border: 1px solid black; padding: 2px;">3,1</span>	kg	KED-Direct 700XF-455Kv
Electric Motors and Controllers Mass (for cruise)	mmotors,cruise =	<span style="background-color: #90EE90; border: 1px solid black; padding: 2px;">1,25</span>	kg	Leomotion L5038-0700
Propellers Mass (for hover)	mpropeller,hover =	<span style="background-color: #90EE90; border: 1px solid black; padding: 2px;">0,5</span>	kg	
Propellers Mass (for cruise)	mpropeller,cruise =	<span style="background-color: #90EE90; border: 1px solid black; padding: 2px;">0,2</span>	kg	
Battery Mass	mbattery =	<span style="background-color: #90EE90; border: 1px solid black; padding: 2px;">3,959</span>	kg	
Additional Mass for Installations	minstalltions =	<span style="background-color: #90EE90; border: 1px solid black; padding: 2px;">1,4</span>	kg	mass for wiring, installations, etc.
Empty Mass	mempty =	<span style="background-color: #90EE90; border: 1px solid black; padding: 2px;">21,109</span>	kg	
Payload Mass	Δ = mMTOM - mempty =	<span style="background-color: #90EE90; border: 1px solid black; padding: 2px;">3,89</span>	kg	
Center of gravity location				
x-location	xCoG =	<span style="background-color: #ADD8E6; border: 1px solid black; padding: 2px;">0</span>	m	
y-location	yCoG =	<span style="background-color: #ADD8E6; border: 1px solid black; padding: 2px;">0</span>	m	

z-location zCoG = 0m

**Efficiencies:**

Description	Symbol	Value	Unit	Comment
<b>Efficiencies for Hover Flight</b>				
Electrical Motor Efficiency (incl. Motor controller efficiency)	helect. motor =	88%		
Figure of Merit	FOM =	0,6		
Battery Efficiency	hbattery =	97%		
Power Management and Distribution Efficiency	hPMAD =	99%		
<b>Efficiencies for Cruise Flight</b>				
Electrical Motor Efficiency (incl. Motor controller efficiency)	helect. motor =	88%		
Propeller Efficiency	hpropeller =	82%		
Battery Efficiency	hbattery =	97%		
Power Management and Distribution Efficiency	hPMAD =	99%		

**Aerodynamics:**

Description	Symbol	Value	Unit	Comment
Oswald Factor	e =	0,88		
Zero Lift Drag Coefficient	CD0 =	0,03		
Cruise Lift Coefficient	CL Cruise =	1,24		
Induced Drag Coefficient	CDi Cruise =	0,03		
Lift to Drag Ratio	L/DCruise =	21,24		
Static Margin	SM =	10%		

**Component specific Energy:**

Description	Symbol	Value	Unit	Comment
Battery Specific Energy	wbattery =	243,0	Wh/kg	

**Aircraft Range Performance Estimation:**

Description	Symbol	Value	Unit	Comment
Required Cruise Thrust	Tcruise =	11,5	N	
Cruise Speed	vcruise =	22,0	m/s	
Range	drange =	100,0	km	
Required Cruise Power	Pcruise =	365,8	W	
Hover nz	nz =	1,1		
Required Hover Power	Phover =	4552,8	W	
Required Power for Avionics	PAvionics =	91,0	W	
Cruise Time	tcruise =	80,8	min	including 5 min reserve
Hover Time	thover =	2,0	min	2 min Hover time is required
Battery Energy	Ebattery =	769,6	Wh	