

## Airbus Cargo Drone Challenge Frame Sheet

*Shaliach*

Version ..... V 2.00  
 Last Update ..... 05.05.2016

Green cells are calculated by formulars 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 : *Shaliach*

### General Requierements

Description	Symbol	Value	Unit	Comment
Maximum Take-Off Mass	mMTOM =	25.0	kg	Shall stay below 25 kg @ 2000m MSL and ISA+20°C
Air Density	r =	0.954	kg/m <sup>3</sup>	

### Geometry Data:

Description	Symbol	Value	Unit	Comment
Wing Span	b =	3.5355339	m	
Aspect Ratio	AR =	11.5	-	c
Wing Area	Sref =	1.0869565	m <sup>2</sup>	0.217391304
Wing Loading (fixed wing mode)	m/Sref =	23	kg/m <sup>2</sup>	10 - 30 kg/m <sup>2</sup> recommendation
Disc Loading (rotor disc)	m/Sprop Lift =	13.8	kg/m <sup>2</sup>	10 - 50 kg/m <sup>2</sup> recommendation
Lift Propeller Area per Lift Propeller	Sprop Lift =	0.453	m <sup>2</sup>	
Lift Propeller Diameter	Dprop Lift =	0.759	m	
Cruise Propeller Diameter	Dprop Cruise =	0.3	m	
Cruise Propeller Area per Cruise Propeller	Sprop Cruise =	0.21	m	
Number of Propeller for Hover	npropeller,hover =	4	-	
Number of Propeller for Cruise	npropeller,cruise =	3	-	
Fuselage Length	Lfuselage =	1.8	m	
Fuselage Diameter (max. Diameter)	Dfuselage =	0.8	m	
Vertical Tail Surface	Svertical tail =		m <sup>2</sup>	
Vertical Tail Leaver Arm to CoG	lvertical tail =		m	
Horizontal Tail/Canard Surface	Shorizontal tail =		m <sup>2</sup>	
Horizontal Tail/Canard Leaver Arm to CoG	lhorizontal tail =		m	
Control Surface Area for Pitch	Scontrol,pitch =		m <sup>2</sup>	
Control Surface Leaver Arm to CoG for Pitch	lcontrol,pitch =		m	
Control Surface Area for Roll	Scontrol,roll =		m <sup>2</sup>	
Control Surface Leaver Arm to CoG for Roll	lcontrol,roll =		m	
Control Surface Area for Yaw	Scontrol,yaw =		m <sup>2</sup>	
Control Surface Leaver Arm to CoG for Yaw	lcontrol,yaw =		m	

### Mass and Balance Data:

Description	Symbol	Value	Unit	Comment
Structural Mass (wing, fuselage, empenage, nacelles, ...)	mstruct =	9.11	kg	
Avionics Mass (see ignition kit)	mavionics =	3.5	kg	
Flight Control Actuation	mactuation =	0	kg	
Electric Motors and Controllers Mass (for hover)	mmotors,hover =	1.604	kg	
Electric Motors and Controllers Mass (for cruise)	mmotors,cruise =	0.156	kg	
Propellers Mass (for hover)	mpropeller,hover =	0.46	kg	
Propellers Mass (for cruise)	mpropeller,cruise =	0.15	kg	
Battery Mass	mbattery =	4.530	kg	4.518
Additional Mass for Installations	minstalltions =	0.5	kg	mass for wiring, installations, etc.
Empty Mass	$\bar{a}$ mempty =	19.998	kg	
Payload Mass	$\bar{d}$ = mMTOM - mempty =	5.00	kg	

Center of gravity location

x-location	xCoG =	1.05	m
y-location	yCoG =	0	m
z-location	zCoG =	0.3	m

**Efficiencies:**

Description	Symbol	Value	Unit	Comment
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Efficiencies for Hover Flight

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%	

Efficiencies for Cruise Flight

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
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Oswald Factor	e =	0.7184	-
Zero Lift Drag Coefficient	CD0=	0.0198	-
Cruise Lift Coefficient	CL Cruise=	0.72	-
Induced Drag Coefficient	CDi Cruise=	0.02	-
Lift to Drag Ratio	L/DCruise =	18.10	-
Static Margin	SM =	5-10%	

**Component specific Energy:**

Description	Symbol	Value	Unit	Comment
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Battery Specific Energy	wbattery =	235.0	Wh/kg
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**Aircraft Range Performance Estimation:**

Description	Symbol	Value	Unit	Comment
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Required Cruise Thrust	Tcruise =	13.5	N	
Cruise Speed	vcruise =	25.6	m/s	
Range	drange =	100.0	km	
Required Cruise Power	Pcruise =	499.4	W	
Hover nz	nz=	1.1	-	
Required Hover Power	Phover =	4690.8	W	
Required Power for Avionics	PAvionics =	93.0	W	
Cruise Time	tcruise =	70.1	min	including 5 min reserve
Hover Time	thover =	2.0	min	2 min Hover time is required
Battery Energy	Ebattery =	851.6	Wh	

