



SAE Aero Micro: Initial Testing Results

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Design Requirements



Engineering Requirements

- ER1 – Wingspan
- ER2 – Cost
- ER3 – Battery Life
- ER4 – Thrust
- ER5 – Cargo Bay
- ER6 – Lift
- ER7 – Drag
- ER8 – Weight
- ER9 – RC Signal Range
- ER10 – Center of Gravity
- ER11 – Ground Control
- ER12 – Flight Control

Customer Requirements

- CR1 – Flight Time
- CR2 – Payload
- CR3 – Turning Radius
- CR4 – RC Signal Range
- CR5 – Take Off
- CR6 – Land
- CR7 – Unload Payload



QFD

Customer Needs	Customer Weights	Wingspan	Cost	Battery	Thrust/Motor	Cargo Bay	Lit	Drag	Thrust	Weight	T/O velo	RC Signal Range	CG Marking	Ground Control	Flight Control	Durability	1 Poor	2	3 Acceptable	4	5 Excellent
Flight Time	9	9	3	1	9	3	9	9	9	3	9	3	3	9	9			AB	C		AB
Payload	9	3		3	9	9	9	1	3	9			9		3	9	AB				C
Turning Radius/Maneuverability	3	3			3	1	1	1	9	1	9	3			3				C		AB
RC Signal Strength (2.4 GHz)	3		1	3								9									ABC
Spare Parts	1	1	3	1												9					
Launch T/O	3	9	1		3	1	9	9	9	9	9			9	3			C		AB	
Landing	3	9	1		1	1	3	3	3	3	3			9	3				C		AB
Unloading Time	9	1												3			AB				C
Technical Requirement Units		in	\$	time	lb/Fwatt	ms	N	N	N	kg	m/s	ft	in								
Technical Requirement Targets		48	2000	2:40	450	144	75	5	20	1.5	22	800	26								
Absolute Technical Importance		181	39	46	183	117	201	129	171	147	144	63	81	108	135	82					
Relative Technical Importance		3	12	11	2	9	1	8	4	5	6	4	6	10	7	7					



Top Level Testing Summary

Experiment/Test	Relevant DRs
Takeoff Test	Thrust (ER4), Max Lift (ER6), Drag (ER7), Weight (ER8), Take-off Speed (ER9), Takeoff (CR6)
Landing Test	CG (ER11), Ground Control (ER12), Durability (ER14), Ability to land (CR7)
Flight Test	Wingspan (ER1), Battery Life (ER3), RC Signal Range (ER10), Flight Control (ER13), Flight Time (CR1), Turning Radius (CR3), RC Signal (CR4)
Maintenance Test	Max Lift (ER5), Carry Payload (CR2), Spare Parts (CR5), Unload Payload (CR8)
Crash Test	Cost (ER2), Battery Life (ER3), Weight (ER8), CG (ER11), Durability (ER14), Landing Distance (CR5)

Specification Sheet Preparation

Engineering Requirement		Target	Tolerance	Measured/Calculated Value	ER Met?	Client Acceptable
Wingspan	ER1	46in	2in	46in	Yes	Pending
Cost	ER2	\$1,500	--	\$738	Yes	Pending
Battery Life	ER3	60s	60s	120s	Yes	Pending
Thrust	ER4	5N	2N	3N	Yes	Pending
Cargo Bay	ER5	6x6x4 in ³	--	--	Yes	Pending
Max Lift	ER6	30N	5N	31.5N	Yes	Pending
Drag	ER7	3N	2N	2N	No	Pending
Weight	ER8	1.2kg	1kg	2.5kg	No	Pending
Take off Speed	ER9	25m/s	2m/s	20m/s	No	Pending
RC Signal Range	ER10	1000ft	200ft	5000ft	Yes	Pending
CG	ER11	--	--	--	Yes	Pending
Ground Control	ER12	N/A	N/A	N/A	No	Pending
Flight Control (Turning Radius)	ER13	120ft	25ft	100ft	No	Pending
Durability	ER14	N/A	N/A	N/A	Yes	Pending
Landing Distance	ER15	200ft	--	--	No	Pending



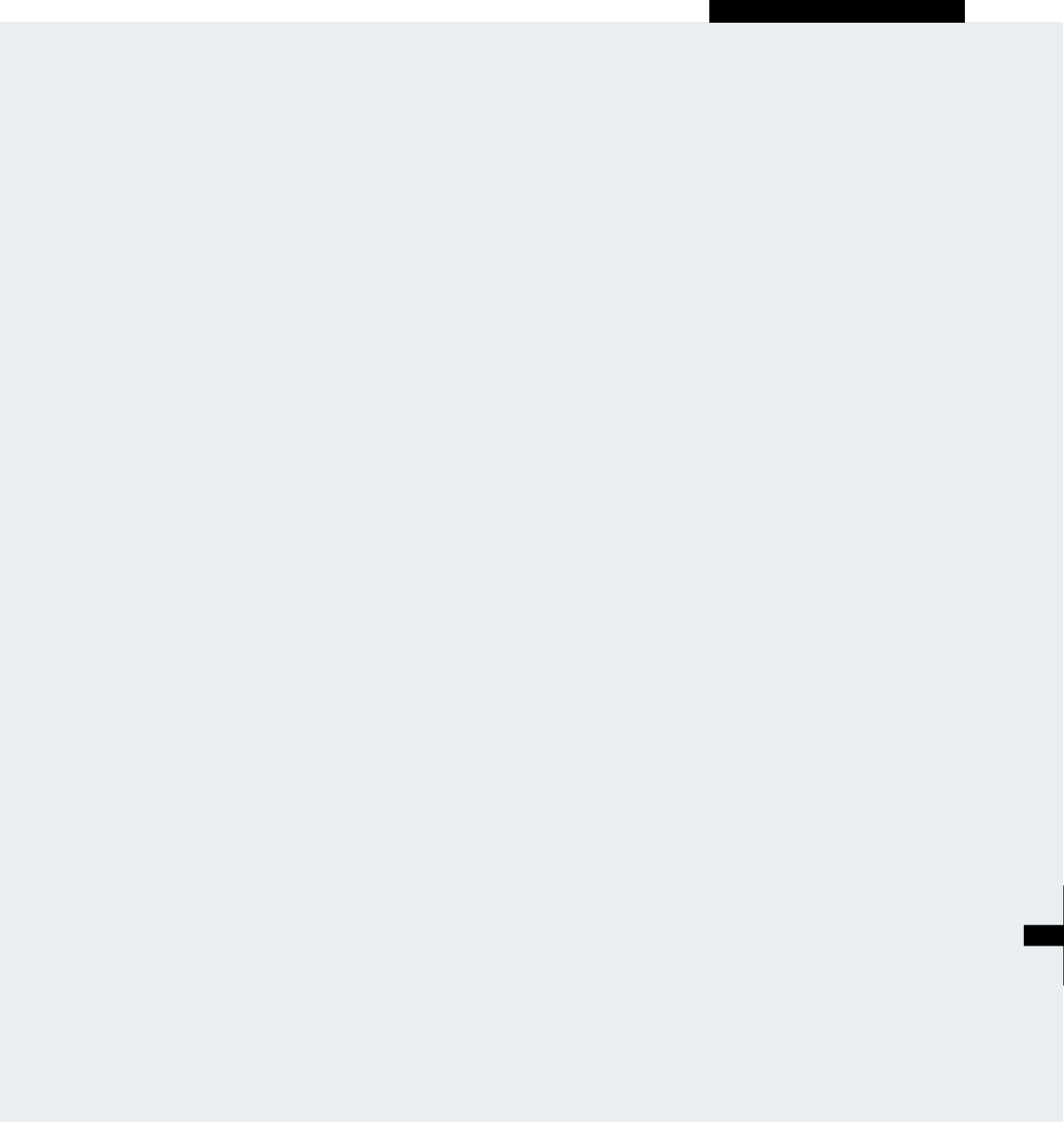
Detailed Testing Plan

- Takeoff Test: Tests the airplane's ability to takeoff from a standstill on the ground.
- Flight Test: Tests the maneuverability of the airplane. Ensures that all control surfaces and the motor are functioning.
- Landing Test: Tests the ability to land the aircraft in a designated 100-foot strip.
- Maintenance Test: Tests the ability of the team to change batteries and load or unload the payload in under 60 seconds.
- Crash Test: Tests the durability of the aircraft in a controlled test.



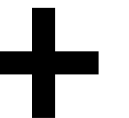
CR Summary

Customer Requirement	CR Met?	Client Acceptable?
Flight Time	Y	Y
Payload	Y	Y
Turning Radius	-	-
RC Signal Range	Y	Y
Takeoff	N	N
Land	N	N
Unload Payload	Y	Y
RC Signal Range	Y	Y
Steering Ability	N	N



Flight Test

- Objectives: Test the airplane's ability to fly the competition circuit.
- Status: Unsuccessful
- Reasons for failure:
 - Too back-heavy
 - No angle of incidence on wing



Landing Test

- Objectives: Ensure plane is capable of landing within the specified 200ft competition requirement
- Status: Unsuccessful
- Reason for failure: Plane is unable to take off, so it cannot land



Maintenance Test

- Objectives: Remove wing, replace battery, insert payload, reattach wing.
- Status: Successful
- Average time: 52 seconds
- Competition requirement: <60 second



Crash Test

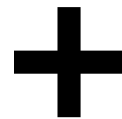
- Objectives: Crash airplane to ensure it can withstand crashing
- Status: Partial Success
- Results: Nose landing gear failed, motor has debris inside housing, and elevator detached. Unable to facilitate a crash initiated in-flight.



— Takeoff Test



<https://www.youtube.com/shorts/CA23daP1I2c>



Additional Videos



Control Surfaces Test

