Xcelerator - QX-250 UAV Program

FMECA (MIL-STD-882E)

This FMECA report is a report based upon the MIL-STD-882E standard and the criticality methodology within. The report lists Failure Modes for each item in the system model that leads to the selected End Effect with associated risk of each failure.

PROJECT DETAILS

Project Name:	Quadcopter Demo
Date of Issue:	Jul 10, 2026, 1:05:14 PM
Report Author:	Chris Martini
Revision:	

DOCUMENT SIGNOFF

Name(s):			
Signature(s):			
Role(s):			
Date:			

DOCUMENT CONTROL

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GLOSSARY OF TERMS

TERM	DEFINITION
Aggregate Mission Parameter	The name/type of the Mission Parameter selected to be aggregated over the total Mission Profile.
Aggregate Total	The total of the Aggregate Mission Parameter for the Mission Profile.
Approved By	The manager or superior approving the analysis report.
Compiled By	The current user or analyst creating the analysis report.
Description (Mission Profile)	An entry field allowing the user to give a detailed narrative of the Mission Profile.
Description (Phase)	An entry field allowing the user to give a detailed narrative of the Mission Phase.
Description (Segment)	An entry field allowing the user to give a detailed narrative of the Mission Segment.
Duration	A numerical value of the length of time for a Mission Profile, Phase or Segment.
Failure Modes and Causes	The manner by which a failure is observed. Generally describes the way the failure occurs and its impact on equipment operation.
Function Name	The listed functional description or intended purpose of a system item.
Group Cycles	The number of Mission Cycles for the Mission Profile in the Group.
Group Ratio	The (time-based) ratio of the Mission Profile with respect to other included Mission Profiles.
ID Number	The unique item number that describes a failure path.
Indenture Level	The item levels which identify or describe relative complexity of assembly or function. The levels progress from the more complex (system) to the simpler (part) divisions.
Item / Functional Identification	The listed identifier and name or nomenclature of the item or system function being analyzed for failure mode and effects.
LCN	The Logistic Control Number (LCN) structure represents a topdown physical or functional breakdown of hardware and software for use within Logistics Support Analysis (LSA).
Mission	An exercise involving sequential and / or concurrent operations that have been planned in order to achieve one or more stated objectives / capabilities.
Mission Cycles	The number of cycles of a mission profile that have been completed. This value is multiplied by the duration of an item to determine its overall Duration of Operation.
Mission Phase / Operational Mode	A concise statement of the mission phase and operational mode in which the failure occurs. It includes the most definitive timing information entered for the assumed time of failure occurrence, where subphase, event, or time can be defined from the system definition and mission profiles.
Name (Mission Profile)	The listed identifier or name of the Mission Profile selected in the Report Wizard.
Name (Phase)	The listed identifier or name of a Mission Phase defined in the Mission Phases and Segments page of the Mission Profile.
Name (Segment)	The listed identifier or name of a Mission Segment defined in the Mission Phases and Segments page of the Mission Profile.
Occurrence	A relative measure of the frequency of which a failure concept is expected to occur, in either a crisp (1 to 10 ranking) or fuzzy (linguistic e.g. high , very high etc.) value. A higher occurrence will result in a higher criticality value.
Phase	A primary division of time for each Mission Profile.
Probability Level	An expression of the likelihood of occurrence of a mishap.
Reference Drawing	Design data and drawings identify each item and the item configuration that perform each of the system functions. System design data and drawings usually describe the system's internal and interface functions beginning at system level and progressing to the lowest indenture level of the system. Design data will usually include either functional block diagrams or schematics that will facilitate construction of reliability block diagrams.
Risk Assessment Code	A combination of the mishap and the probability that the mishap will occur.
Segment	A secondary division of time profile under each Mission Phase.
Severity Category	The magnitude of potential consequences of a mishap to include: death, injury, occupational illness, damage to or loss of equipment or property, damage to the environment, or monetary loss.
System	Lists the defined item name of the system in the highest level of indenture.
Time	A rolling cumulative by adding time durations for Phases and Segments in a Mission Profile.

MIL-STD-882E CRITICALITY DEFINITIONS & TABLES

PROBABILITY LEVEL	DESCRIPTION	OCCURRENCE
Frequent	Likely to occur often in the life of an item.	8.5<O≤10.0
Probable	Will occur several times in the life of an item.	7.0<O≤8.5
Occasional	Likely to occur sometime in the life of an item.	5.5<O≤7.0
Remote	Unlikely, but possible to occur in the life of an item.	4.0<O≤5.5
Improbable	So unlikely, it can be assumed occurrence may not be experienced in the life of an item.	2.5<O≤4.0
Eliminated	Incapable of occurrence. This level is used when potential hazards are identified and later eliminated.	1.0≤O≤2.5
SEVERITY CATEGORY	**MISHAP RESULT CRITERIA**	**SEVERITY**
Catastrophic	Could result in one or more of the following: death, permanent total disability, irreversible significant environmental impact, or monetary loss equal to or exceeding $10M.	7.9<S≤10.0
Critical	Could result in one or more of the following: permanent partial disability, injuries or occupational illness that may result in hospitalisation of at least three personnel, reversible significant environmental impact, or monetary loss equal to or exceeding $1M.	5.4<S≤7.9
Marginal	Could result in one or more of the following: injury or occupational illness resulting in one or more lost work day(s), reversible moderate environmental impact, or monetary loss equal to or exceeding $100K but less than $1M.	2.9<S≤5.4
Negligible	Could result in one or more of the following: injury or occupational illness not resulting in a lost work day, minimal environmental impact, or monetary loss less than $100K.	1.0≤S≤2.9

RISK ASSESSMENT MATRIX

PROBABILITY/ SEVERITY	CATASTROPHIC	CRITICAL	MARGINAL	NEGLIGIBLE
Frequent	High	High	Serious	Medium
Probable	High	High	Serious	Medium
Occasional	High	Serious	Medium	Low
Remote	Serious	Medium	Medium	Low
Improbable	Medium	Medium	Medium	Low
Eliminated	Eliminated	Eliminated	Eliminated	Eliminated

MISSION PROFILE SUMMARY

NAME	QX-250 Nominal Sortie	**DESCRIPTION**
DURATION	10.5m	Representative 10-minute QX-250 quadcopter sortie: startup, takeoff/climb, cruise, hover payload task, aggressive maneuver, return, and landing. Used to accrue stress/duty on the battery, ESC, motor, and propeller for RBD and criticality analysis.
MISSION CYCLES	1.00	

ID	CODE	NAME	DURATION	ELAPSED TIME	DESCRIPTION
1	P1	Startup & Pre-flight	2m	0.033h	
2	P2	Takeoff & Climb	0.5m	0.042h	
3	P3	Cruise / Transit	4m	0.108h	
4	P4	Hover / Payload Task	2m	0.142h	
5	P5	Aggressive Maneuver	1m	0.158h	
6	P6	Return / Descent	0.5m	0.167h	
7	P7	Landing	0.5m	0.175h	

SYSTEM Quadcopter UAV
INDENTURE LEVEL 1
REFERENCE DRAWING
MISSION QX-250 Nominal Sortie

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COMPILED BY Chris Martini
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ID NUMBER	ITEM/FUNCTIONAL IDENTIFICATION	FUNCTION #	FUNCTION NAME	FAILURE MODES AND CAUSES #	FAILURE MODES AND CAUSES	MISSION PHASE/ OPERATIONAL MODE	CRITICALITY					CONTROL MEASURES
							OCCURRENCE	PROBABILITY LEVEL	SEVERITY	SEVERITY CATEGORY	RISK ASSESSMENT CODE	
	Quadcopter UAV	01-01-01	Convert Continuous Amplitude	D	Low Continuous Amplitude of the Quadcopter UAV due to Low Continuous Amplitude of the Flight Controller (ESC)	1: Startup & Pre-flight [100%] 2: Takeoff & Climb [100%] 3: Cruise / Transit [100%] 4: Hover / Payload Task [100%] 5: Aggressive Maneuver [100%] 6: Return / Descent [100%] 7: Landing [100%]	10.0	Frequent	10.0	Catastrophic	High (1A)	
		01-02-02	Convert Pneumatic Pressure	C	Low Pneumatic Pressure of the Quadcopter UAV due to Low Electrical Voltage of the Flight Controller (ESC)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				C	Low Pneumatic Pressure of the Quadcopter UAV due to Low Electrical Voltage of the LiPo Battery		10.0	Frequent	10.0	Catastrophic	High (1A)	
				C	Low Pneumatic Pressure of the Quadcopter UAV due to Low Mechanical - rotational Angular velocity of the Brushless Motor		10.0	Frequent	10.0	Catastrophic	High (1A)	
				C	Low Pneumatic Pressure of the Quadcopter UAV due to Low Pneumatic Pressure of the Propeller		10.0	Frequent	10.0	Catastrophic	High (1A)	

SYSTEM Quadcopter UAV >Brushless Motor
INDENTURE LEVEL 2
REFERENCE DRAWING
MISSION QX-250 Nominal Sortie

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ID NUMBER	ITEM/FUNCTIONAL IDENTIFICATION	FUNCTION #	FUNCTION NAME	FAILURE MODES AND CAUSES #	FAILURE MODES AND CAUSES	MISSION PHASE/ OPERATIONAL MODE	CRITICALITY					CONTROL MEASURES
							OCCURRENCE	PROBABILITY LEVEL	SEVERITY	SEVERITY CATEGORY	RISK ASSESSMENT CODE	
	Brushless Motor A machine that converts electrical energy into mechanical energy, typically rotational motion.	01-01-01	Convert Mechanical - rotational Angular velocity An electric motor functions to convert electrical voltage into mechanical rotational angular velocity.	B	Low Mechanical - rotational Angular velocity due to pitting of the Brushless Motor as a result of corrosive attack caused by corrosive contaminant and damaged surface protection and insufficient cleaning resulting in Low Pneumatic Pressure (Quadcopter UAV)	1: Startup & Pre-flight [100%] 2: Takeoff & Climb [100%] 3: Cruise / Transit [100%] 4: Hover / Payload Task [100%] 5: Aggressive Maneuver [100%] 6: Return / Descent [100%] 7: Landing [100%]	10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Mechanical - rotational Angular velocity due to pitting of the Brushless Motor as a result of corrosive attack caused by corrosive contaminant and damaged surface protection and untimely maintenance actions resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Mechanical - rotational Angular velocity due to circuit breaking of the Brushless Motor as a result of dielectric breakdown caused by over-voltage resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Mechanical - rotational Angular velocity due to circuit breaking of the Brushless Motor as a result of dielectric breakdown caused by over-current resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Mechanical - rotational Angular velocity due to circuit breaking of the Brushless Motor as a result of dielectric breakdown caused by line defects resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Mechanical - rotational Angular velocity due to circuit breaking of the Brushless Motor as a result of burnout caused by transient electrical loads resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Mechanical - rotational Angular velocity due to circuit breaking of the Brushless Motor as a result of burnout caused by over-current resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Mechanical - rotational Angular velocity due to circuit breaking of the Brushless Motor as a result of burnout caused by over-voltage resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Mechanical - rotational Angular velocity due to circuit breaking of the Brushless Motor as a result of burnout caused by short circuit resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Mechanical - rotational Angular velocity due to circuit breaking of the Brushless Motor as a result of burnout caused by electrical resistance low resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Mechanical - rotational Angular velocity due to circuit breaking of the Brushless Motor as a result of burnout caused by electrical potential high resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Mechanical - rotational Angular velocity due to fracturing of the Brushless Motor as a result of high cycle fatigue caused by cyclic mechanical loads and imbalanced mechanical loads and vibration loading resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Mechanical - rotational Angular velocity due to fracturing of the Brushless Motor as a result of thermal fatigue caused by temperature fluctuations resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Mechanical - rotational Angular velocity due to corroding of the Brushless Motor as a result of corrosive attack caused by corrosive contaminant and damaged surface protection and insufficient cleaning resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Mechanical - rotational Angular velocity due to corroding of the Brushless Motor as a result of corrosive attack caused by corrosive contaminant and damaged surface protection and untimely maintenance actions resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	

SYSTEM Quadcopter UAV >Brushless Motor
INDENTURE LEVEL 2
REFERENCE DRAWING
MISSION QX-250 Nominal Sortie

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ID NUMBER	ITEM/FUNCTIONAL IDENTIFICATION	FUNCTION #	FUNCTION NAME	FAILURE MODES AND CAUSES #	FAILURE MODES AND CAUSES	MISSION PHASE/ OPERATIONAL MODE	CRITICALITY					CONTROL MEASURES
							OCCURRENCE	PROBABILITY LEVEL	SEVERITY	SEVERITY CATEGORY	RISK ASSESSMENT CODE	
	Brushless Motor A machine that converts electrical energy into mechanical energy, typically rotational motion.	01-01-01	Convert Mechanical - rotational Angular velocity An electric motor functions to convert electrical voltage into mechanical rotational angular velocity.	B	Low Mechanical - rotational Angular velocity due to property mismatching of the Brushless Motor as a result of burnout caused by over-voltage resulting in Low Pneumatic Pressure (Quadcopter UAV)	1: Startup & Pre-flight [100%] 2: Takeoff & Climb [100%] 3: Cruise / Transit [100%] 4: Hover / Payload Task [100%] 5: Aggressive Maneuver [100%] 6: Return / Descent [100%] 7: Landing [100%]	10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Mechanical - rotational Angular velocity due to property mismatching of the Brushless Motor as a result of burnout caused by electrical potential high resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Mechanical - rotational Angular velocity due to property mismatching of the Brushless Motor as a result of burnout caused by transient electrical loads resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Mechanical - rotational Angular velocity due to property mismatching of the Brushless Motor as a result of burnout caused by short circuit resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Mechanical - rotational Angular velocity due to property mismatching of the Brushless Motor as a result of burnout caused by over-current resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Mechanical - rotational Angular velocity due to property mismatching of the Brushless Motor as a result of burnout caused by electrical resistance low resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Mechanical - rotational Angular velocity due to perforating of the Brushless Motor as a result of corrosive attack caused by corrosive contaminant and damaged surface protection and untimely maintenance actions resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Mechanical - rotational Angular velocity due to perforating of the Brushless Motor as a result of corrosive attack caused by corrosive contaminant and damaged surface protection and insufficient cleaning resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Mechanical - rotational Angular velocity due to decreasing dielectric strength of the Brushless Motor as a result of dielectric breakdown caused by over-voltage resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Mechanical - rotational Angular velocity due to decreasing dielectric strength of the Brushless Motor as a result of dielectric breakdown caused by line defects resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Mechanical - rotational Angular velocity due to decreasing dielectric strength of the Brushless Motor as a result of dielectric breakdown caused by over-current resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Mechanical - rotational Angular velocity due to electrical potential decreasing of the Brushless Motor as a result of burnout caused by short circuit resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Mechanical - rotational Angular velocity due to electrical potential decreasing of the Brushless Motor as a result of burnout caused by electrical resistance low resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Mechanical - rotational Angular velocity due to electrical potential decreasing of the Brushless Motor as a result of burnout caused by transient electrical loads resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Mechanical - rotational Angular velocity due to electrical potential decreasing of the Brushless Motor as a result of burnout caused by over-current resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Mechanical - rotational Angular velocity due to electrical potential decreasing of the Brushless Motor as a result of burnout caused by over-voltage resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	

SYSTEM Quadcopter UAV >Brushless Motor
INDENTURE LEVEL 2
REFERENCE DRAWING
MISSION QX-250 Nominal Sortie

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ID NUMBER	ITEM/FUNCTIONAL IDENTIFICATION	FUNCTION #	FUNCTION NAME	FAILURE MODES AND CAUSES #	FAILURE MODES AND CAUSES	MISSION PHASE/ OPERATIONAL MODE	CRITICALITY					CONTROL MEASURES
							OCCURRENCE	PROBABILITY LEVEL	SEVERITY	SEVERITY CATEGORY	RISK ASSESSMENT CODE	
	Brushless Motor A machine that converts electrical energy into mechanical energy, typically rotational motion.	01-01-01	Convert Mechanical - rotational Angular velocity An electric motor functions to convert electrical voltage into mechanical rotational angular velocity.	B	Low Mechanical - rotational Angular velocity due to electrical potential decreasing of the Brushless Motor as a result of burnout caused by electrical potential high resulting in Low Pneumatic Pressure (Quadcopter UAV)	1: Startup & Pre-flight [100%] 2: Takeoff & Climb [100%] 3: Cruise / Transit [100%] 4: Hover / Payload Task [100%] 5: Aggressive Maneuver [100%] 6: Return / Descent [100%] 7: Landing [100%]	10.0	Frequent	10.0	Catastrophic	High (1A)	

SYSTEM Quadcopter UAV >Flight Controller (ESC)
INDENTURE LEVEL 2
REFERENCE DRAWING
MISSION QX-250 Nominal Sortie

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ID NUMBER	ITEM/FUNCTIONAL IDENTIFICATION	FUNCTION #	FUNCTION NAME	FAILURE MODES AND CAUSES #	FAILURE MODES AND CAUSES	MISSION PHASE/ OPERATIONAL MODE	CRITICALITY					CONTROL MEASURES
							OCCURRENCE	PROBABILITY LEVEL	SEVERITY	SEVERITY CATEGORY	RISK ASSESSMENT CODE	
	Flight Controller (ESC) This control unit senses the electrical energy output of the alternator. Based on this output energy it then controls the voltage supplied to the rotor, therefore controlling the output power of the alternator. It also sends a signal to the engine governor to maintain engine speed so the AC output of the generator is always 50Hz.	01-01-01	Process Continuous Amplitude Modelled as a resistive device, dissipating a small amount of electrical energy as a result of internal resistance.	D	Low Continuous Amplitude due to circuit shorting of the Flight Controller (ESC) as a result of dielectric breakdown caused by over-voltage resulting in Low Continuous Amplitude (Quadcopter UAV)	1: Startup & Pre-flight [100%] 2: Takeoff & Climb [100%] 3: Cruise / Transit [100%] 4: Hover / Payload Task [100%] 5: Aggressive Maneuver [100%] 6: Return / Descent [100%] 7: Landing [100%]	10.0	Frequent	10.0	Catastrophic	High (1A)	
				D	Low Continuous Amplitude due to circuit shorting of the Flight Controller (ESC) as a result of dielectric breakdown caused by line defects resulting in Low Continuous Amplitude (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				D	Low Continuous Amplitude due to circuit shorting of the Flight Controller (ESC) as a result of dielectric breakdown caused by over-current resulting in Low Continuous Amplitude (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				D	Low Continuous Amplitude due to circuit shorting of the Flight Controller (ESC) as a result of burnout caused by transient electrical loads resulting in Low Continuous Amplitude (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				D	Low Continuous Amplitude due to circuit shorting of the Flight Controller (ESC) as a result of burnout caused by over-current resulting in Low Continuous Amplitude (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				D	Low Continuous Amplitude due to circuit shorting of the Flight Controller (ESC) as a result of burnout caused by over-voltage resulting in Low Continuous Amplitude (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				D	Low Continuous Amplitude due to circuit shorting of the Flight Controller (ESC) as a result of burnout caused by short circuit resulting in Low Continuous Amplitude (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				D	Low Continuous Amplitude due to circuit shorting of the Flight Controller (ESC) as a result of burnout caused by electrical resistance low resulting in Low Continuous Amplitude (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				D	Low Continuous Amplitude due to circuit shorting of the Flight Controller (ESC) as a result of burnout caused by electrical potential high resulting in Low Continuous Amplitude (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				D	Low Continuous Amplitude due to circuit breaking of the Flight Controller (ESC) as a result of dielectric breakdown caused by over-voltage resulting in Low Continuous Amplitude (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				D	Low Continuous Amplitude due to circuit breaking of the Flight Controller (ESC) as a result of dielectric breakdown caused by line defects resulting in Low Continuous Amplitude (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				D	Low Continuous Amplitude due to circuit breaking of the Flight Controller (ESC) as a result of dielectric breakdown caused by over-current resulting in Low Continuous Amplitude (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				D	Low Continuous Amplitude due to circuit breaking of the Flight Controller (ESC) as a result of burnout caused by electrical resistance low resulting in Low Continuous Amplitude (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				D	Low Continuous Amplitude due to circuit breaking of the Flight Controller (ESC) as a result of burnout caused by over-current resulting in Low Continuous Amplitude (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				D	Low Continuous Amplitude due to circuit breaking of the Flight Controller (ESC) as a result of burnout caused by over-voltage resulting in Low Continuous Amplitude (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				D	Low Continuous Amplitude due to circuit breaking of the Flight Controller (ESC) as a result of burnout caused by electrical potential high resulting in Low Continuous Amplitude (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	

SYSTEM Quadcopter UAV >Flight Controller (ESC)
INDENTURE LEVEL 2
REFERENCE DRAWING
MISSION QX-250 Nominal Sortie

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ID NUMBER	ITEM/FUNCTIONAL IDENTIFICATION	FUNCTION #	FUNCTION NAME	FAILURE MODES AND CAUSES #	FAILURE MODES AND CAUSES	MISSION PHASE/ OPERATIONAL MODE	CRITICALITY					CONTROL MEASURES
							OCCURRENCE	PROBABILITY LEVEL	SEVERITY	SEVERITY CATEGORY	RISK ASSESSMENT CODE	
	Flight Controller (ESC) This control unit senses the electrical energy output of the alternator. Based on this output energy it then controls the voltage supplied to the rotor, therefore controlling the output power of the alternator. It also sends a signal to the engine governor to maintain engine speed so the AC output of the generator is always 50Hz.	01-01-01	Process Continuous Amplitude Modelled as a resistive device, dissipating a small amount of electrical energy as a result of internal resistance.	D	Low Continuous Amplitude due to circuit breaking of the Flight Controller (ESC) as a result of burnout caused by short circuit resulting in Low Continuous Amplitude (Quadcopter UAV)	1: Startup & Pre-flight [100%] 2: Takeoff & Climb [100%] 3: Cruise / Transit [100%] 4: Hover / Payload Task [100%] 5: Aggressive Maneuver [100%] 6: Return / Descent [100%] 7: Landing [100%]	10.0	Frequent	10.0	Catastrophic	High (1A)	
				D	Low Continuous Amplitude due to circuit breaking of the Flight Controller (ESC) as a result of burnout caused by transient electrical loads resulting in Low Continuous Amplitude (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
		01-02-02	Process Electrical Voltage Modelled as a resistive device, dissipating a small amount of electrical energy as a result of internal resistance.	C	Low Electrical Voltage due to circuit shorting of the Flight Controller (ESC) as a result of dielectric breakdown caused by over-current resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				C	Low Electrical Voltage due to circuit shorting of the Flight Controller (ESC) as a result of dielectric breakdown caused by over-voltage resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				C	Low Electrical Voltage due to circuit shorting of the Flight Controller (ESC) as a result of dielectric breakdown caused by line defects resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				C	Low Electrical Voltage due to circuit shorting of the Flight Controller (ESC) as a result of burnout caused by transient electrical loads resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				C	Low Electrical Voltage due to circuit shorting of the Flight Controller (ESC) as a result of burnout caused by over-current resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				C	Low Electrical Voltage due to circuit shorting of the Flight Controller (ESC) as a result of burnout caused by short circuit resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				C	Low Electrical Voltage due to circuit shorting of the Flight Controller (ESC) as a result of burnout caused by over-voltage resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				C	Low Electrical Voltage due to circuit shorting of the Flight Controller (ESC) as a result of burnout caused by electrical resistance low resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				C	Low Electrical Voltage due to circuit shorting of the Flight Controller (ESC) as a result of burnout caused by electrical potential high resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				C	Low Electrical Voltage due to circuit breaking of the Flight Controller (ESC) as a result of dielectric breakdown caused by over-voltage resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				C	Low Electrical Voltage due to circuit breaking of the Flight Controller (ESC) as a result of dielectric breakdown caused by line defects resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				C	Low Electrical Voltage due to circuit breaking of the Flight Controller (ESC) as a result of dielectric breakdown caused by over-current resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				C	Low Electrical Voltage due to circuit breaking of the Flight Controller (ESC) as a result of burnout caused by electrical resistance low resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				C	Low Electrical Voltage due to circuit breaking of the Flight Controller (ESC) as a result of burnout caused by short circuit resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				C	Low Electrical Voltage due to circuit breaking of the Flight Controller (ESC) as a result of burnout caused by transient electrical loads resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	

SYSTEM Quadcopter UAV >Flight Controller (ESC)
INDENTURE LEVEL 2
REFERENCE DRAWING
MISSION QX-250 Nominal Sortie

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COMPILED BY Chris Martini
APPROVED BY

ID NUMBER	ITEM/FUNCTIONAL IDENTIFICATION	FUNCTION #	FUNCTION NAME	FAILURE MODES AND CAUSES #	FAILURE MODES AND CAUSES	MISSION PHASE/ OPERATIONAL MODE	CRITICALITY					CONTROL MEASURES
							OCCURRENCE	PROBABILITY LEVEL	SEVERITY	SEVERITY CATEGORY	RISK ASSESSMENT CODE	
	Flight Controller (ESC) This control unit senses the electrical energy output of the alternator. Based on this output energy it then controls the voltage supplied to the rotor, therefore controlling the output power of the alternator. It also sends a signal to the engine governor to maintain engine speed so the AC output of the generator is always 50Hz.	01-02-02	Process Electrical Voltage Modelled as a resistive device, dissipating a small amount of electrical energy as a result of internal resistance.	C	Low Electrical Voltage due to circuit breaking of the Flight Controller (ESC) as a result of burnout caused by electrical potential high resulting in Low Pneumatic Pressure (Quadcopter UAV)	1: Startup & Pre-flight [100%] 2: Takeoff & Climb [100%] 3: Cruise / Transit [100%] 4: Hover / Payload Task [100%] 5: Aggressive Maneuver [100%] 6: Return / Descent [100%] 7: Landing [100%]	10.0	Frequent	10.0	Catastrophic	High (1A)	
				C	Low Electrical Voltage due to circuit breaking of the Flight Controller (ESC) as a result of burnout caused by over-voltage resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				C	Low Electrical Voltage due to circuit breaking of the Flight Controller (ESC) as a result of burnout caused by over-current resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	

SYSTEM Quadcopter UAV >LiPo Battery
INDENTURE LEVEL 2
REFERENCE DRAWING
MISSION QX-250 Nominal Sortie

DATE Jul 10, 2026, 1:05:14 PM
SHEET 12 **OF** 13
COMPILED BY Chris Martini
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ID NUMBER	ITEM/FUNCTIONAL IDENTIFICATION	FUNCTION #	FUNCTION NAME	FAILURE MODES AND CAUSES #	FAILURE MODES AND CAUSES	MISSION PHASE/ OPERATIONAL MODE	CRITICALITY					CONTROL MEASURES
							OCCURRENCE	PROBABILITY LEVEL	SEVERITY	SEVERITY CATEGORY	RISK ASSESSMENT CODE	
	LiPo Battery An electrical battery using combination of lead and acids to convert stored chemical energy into electrical energy.	01-01-01	Supply Electrical Voltage Modelled as an electrical storage device which converts stored chemical energy into electrical energy.	B	Low Electrical Voltage due to circuit shorting of the LiPo Battery as a result of electrostatic spark discharge caused by mishandling resulting in Low Pneumatic Pressure (Quadcopter UAV)	1: Startup & Pre-flight [100%] 2: Takeoff & Climb [100%] 3: Cruise / Transit [100%] 4: Hover / Payload Task [100%] 5: Aggressive Maneuver [100%] 6: Return / Descent [100%] 7: Landing [100%]	10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Electrical Voltage due to chemical reactivity decreasing of the LiPo Battery as a result of thermal decomposition caused by high temperature resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Electrical Voltage due to weakening of the LiPo Battery as a result of electrolysis caused by ionic contaminant resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Electrical Voltage due to decreasing dielectric strength of the LiPo Battery as a result of electrostatic spark discharge caused by mishandling resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Electrical Voltage due to decreasing dielectric strength of the LiPo Battery as a result of dielectric breakdown caused by over-current resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Electrical Voltage due to decreasing dielectric strength of the LiPo Battery as a result of dielectric breakdown caused by over-voltage resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Electrical Voltage due to decreasing dielectric strength of the LiPo Battery as a result of dielectric breakdown caused by item life-span exceeded resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Electrical Voltage due to decreasing dielectric strength of the LiPo Battery as a result of dielectric breakdown caused by line defects resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Electrical Voltage due to corroding of the LiPo Battery as a result of electrolysis caused by ionic contaminant resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Electrical Voltage due to conductivity increasing of the LiPo Battery as a result of electrolysis caused by ionic contaminant resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Electrical Voltage due to circuit breaking of the LiPo Battery as a result of dielectric breakdown caused by item life-span exceeded resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Electrical Voltage due to circuit breaking of the LiPo Battery as a result of dielectric breakdown caused by over-current resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Electrical Voltage due to circuit breaking of the LiPo Battery as a result of dielectric breakdown caused by over-voltage resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Electrical Voltage due to circuit breaking of the LiPo Battery as a result of dielectric breakdown caused by line defects resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Electrical Voltage due to circuit breaking of the LiPo Battery as a result of electrostatic spark discharge caused by mishandling resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	

SYSTEM Quadcopter UAV >Propeller
INDENTURE LEVEL 2
REFERENCE DRAWING
MISSION QX-250 Nominal Sortie

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COMPILED BY Chris Martini
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ID NUMBER	ITEM/FUNCTIONAL IDENTIFICATION	FUNCTION #	FUNCTION NAME	FAILURE MODES AND CAUSES #	FAILURE MODES AND CAUSES	MISSION PHASE/ OPERATIONAL MODE	CRITICALITY					CONTROL MEASURES
							OCCURRENCE	PROBABILITY LEVEL	SEVERITY	SEVERITY CATEGORY	RISK ASSESSMENT CODE	
	Propeller A centrifugal pump uses rotational motion to turn mechanical energy into pneumatic pressure.	01-01-01	Control Pneumatic Pressure A centrifugarl pump functions to control a pneumatic pressure based on an angular velocity.	B	Low Pneumatic Pressure due to abrading of the Propeller as a result of abrasive wear caused by solid particle contaminants resulting in Low Pneumatic Pressure (Quadcopter UAV)	1: Startup & Pre-flight [100%] 2: Takeoff & Climb [100%] 3: Cruise / Transit [100%] 4: Hover / Payload Task [100%] 5: Aggressive Maneuver [100%] 6: Return / Descent [100%] 7: Landing [100%]	10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Pneumatic Pressure due to stretching of the Propeller as a result of ductile fracture caused by high mechanical load resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Pneumatic Pressure due to stretching of the Propeller as a result of ductile fracture caused by impact loads resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Pneumatic Pressure due to blocking of the Propeller as a result of buildup of debris caused by insufficient cleaning and solid particle contaminants resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Pneumatic Pressure due to blocking of the Propeller as a result of buildup of debris caused by contaminated input flow and insufficient cleaning resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Pneumatic Pressure due to seizing of the Propeller as a result of buildup of debris caused by contaminated input flow and insufficient cleaning resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Pneumatic Pressure due to seizing of the Propeller as a result of buildup of debris caused by insufficient cleaning and solid particle contaminants resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Pneumatic Pressure due to fracturing of the Propeller as a result of ductile fracture caused by high mechanical load resulting in Low Pneumatic Pressure (Quadcopter UAV)		4.0	Improbable	10.0	Catastrophic	Medium (1E)	
				B	Low Pneumatic Pressure due to fracturing of the Propeller as a result of ductile fracture caused by impact loads resulting in Low Pneumatic Pressure (Quadcopter UAV)		4.0	Improbable	10.0	Catastrophic	Medium (1E)	
				B	Low Pneumatic Pressure due to fracturing of the Propeller as a result of high cycle fatigue caused by cyclic mechanical loads and imbalanced mechanical loads and vibration loading resulting in Low Pneumatic Pressure (Quadcopter UAV)		4.0	Improbable	10.0	Catastrophic	Medium (1E)	
				B	Low Pneumatic Pressure due to scratching of the Propeller as a result of abrasive wear caused by solid particle contaminants resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Pneumatic Pressure due to interfering of the Propeller as a result of buildup of debris caused by insufficient cleaning and solid particle contaminants resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	
				B	Low Pneumatic Pressure due to interfering of the Propeller as a result of buildup of debris caused by contaminated input flow and insufficient cleaning resulting in Low Pneumatic Pressure (Quadcopter UAV)		10.0	Frequent	10.0	Catastrophic	High (1A)	