Firefighting RC Aircraft

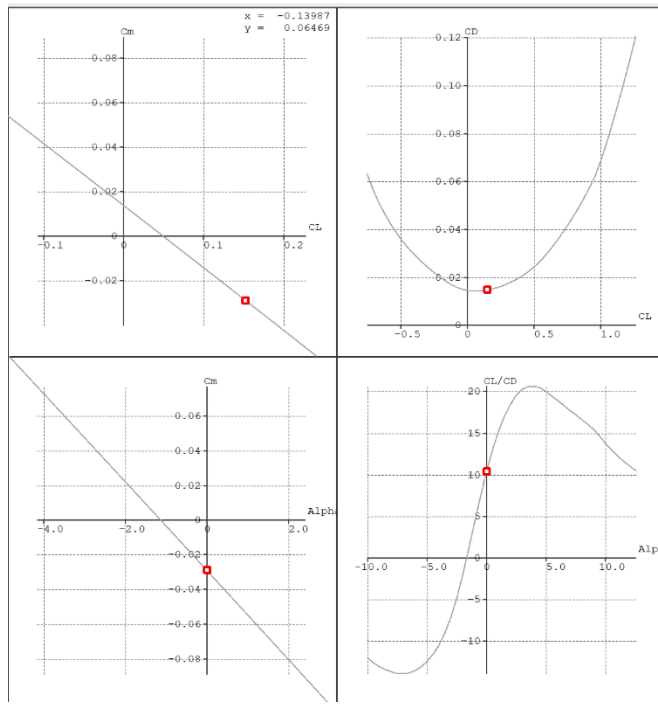
Problem: Create a prototype that supports the integration of electronics that collects data on surroundings

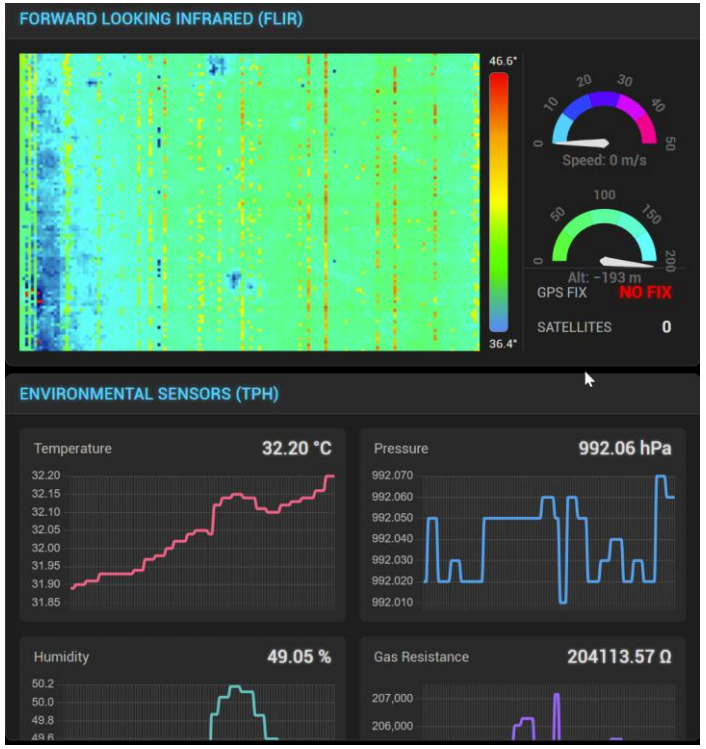
Method:

- Design from first principles and mission requirements, revise based on initial flight test data and stability simulations
- Build using lightweight and durable material
- Solder connectors and wires to support electronics

Solution:

- Working prototype capable of smooth flying
- Successful integration of TPH sensor and thermal camera for live telemetry and data collection





Conceptual Aircraft Design

Problem: Produce a conceptual design to meet customer requirements

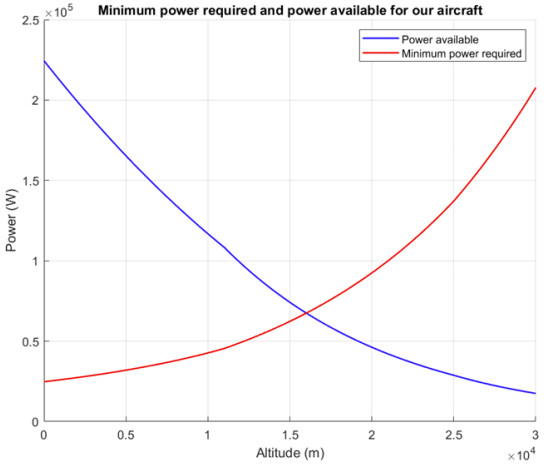
Method:

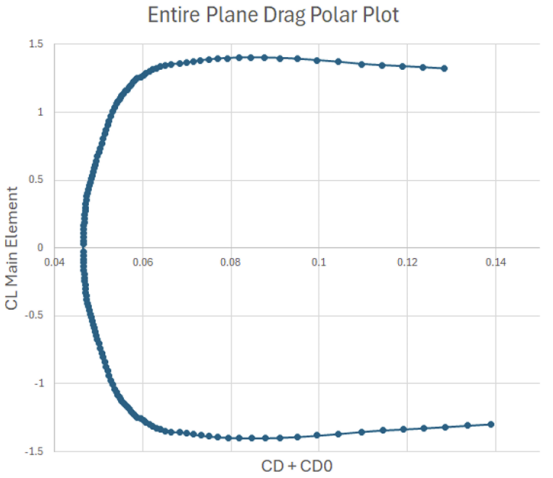
- Define mission profile and requirements
- Choose configuration based on historical data and weighted decision matrices
- Iteratively size the aircraft using MATLAB scripts

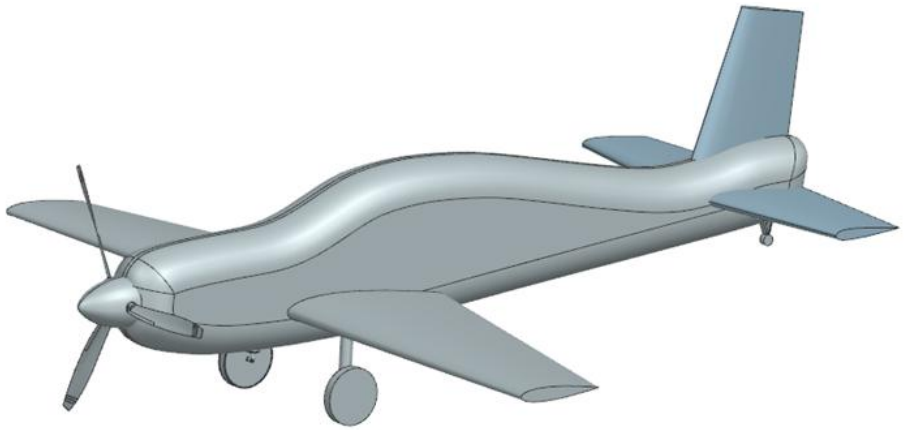
Solution:

- Converged, conceptual aircraft configuration optimized for the mission
- Comprehensive technical report detailing overall design process and outlining next steps in prototyping and testing

Parameter	Symbol	Value
Wingspan	b	6.12 m
Wing area	S	6.192 m^2
Wing aspect ratio	AR_w	6.05
Tip chord	c_{tip}	0.675 m
Root chord	c_{root}	1.35 m
MAC	c_{bar}	1.05 m
Winglets?	N/A	No
Landing gear type?	N/A	Fixed
Prop. Efficiency	η_p	0.86
Empty weight	m_{empty}	517.5 kg
MTOW	m_{TO}	683 kg
Length	l	5.17 m
Height	h	1.97 m
V-Stab area	S_{VT}	0.816 m^2
H-Stab area	S_{HT}	1.5 m^2







Finite Wing Wind Tunnel Test

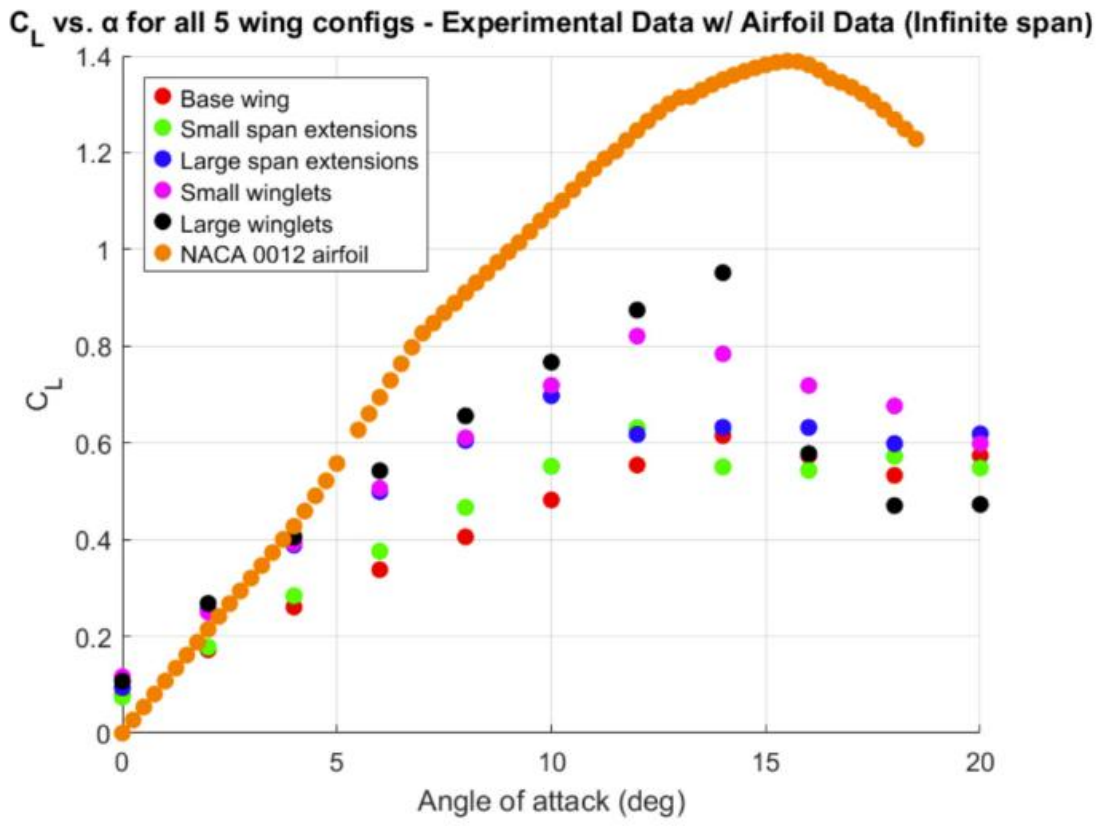
Problem: Compare aerodynamic data of wing to that of its airfoil

Method:

- Select an airfoil and create model of wing
- Configure and operate low-speed wind tunnel for testing
- Collect data of various wing spans and winglet configurations using load cells

Results:

- Visualized the effect of wing-tip vortices on lift
- Demonstrated how winglets can improve aerodynamic performance
- Increased understanding of how error can impact experimental data



Rocket Fin Analysis

Problem: Analyze aerodynamic data of varying fin geometry on model rocket in low-speed environment (“launch”)

Method:

- Generate fin geometries using CAD software
- Configure and operate low-speed wind tunnel for testing
- Collect data using load cells

Results:

- Obtained meaningful drag data
- Presented experimental results in comprehensive lab report

Figure 1.1: Model rocket without fins

Figure 1.2: Model rocket with small fins

Figure 1.3: Model rocket with large fins