

# AERIAL FIREFIGHTING AIRCRAFT : WILDFIRE WARRIOR



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## Introduction

Wildfire Warrior is a specialized firefighting aircraft designed to tackle wildfires with precision and efficiency. Equipped with modern systems for aerial fire suppression, it is capable of performing water or retardant drops using pilot targeting and release mechanisms. With enhanced endurance, it can operate in challenging environments and diverse altitudes, meeting critical mission requirements. Its dual-purpose design allows for secondary cargo transport when not deployed for firefighting, ensuring versatility and maximum operational value.

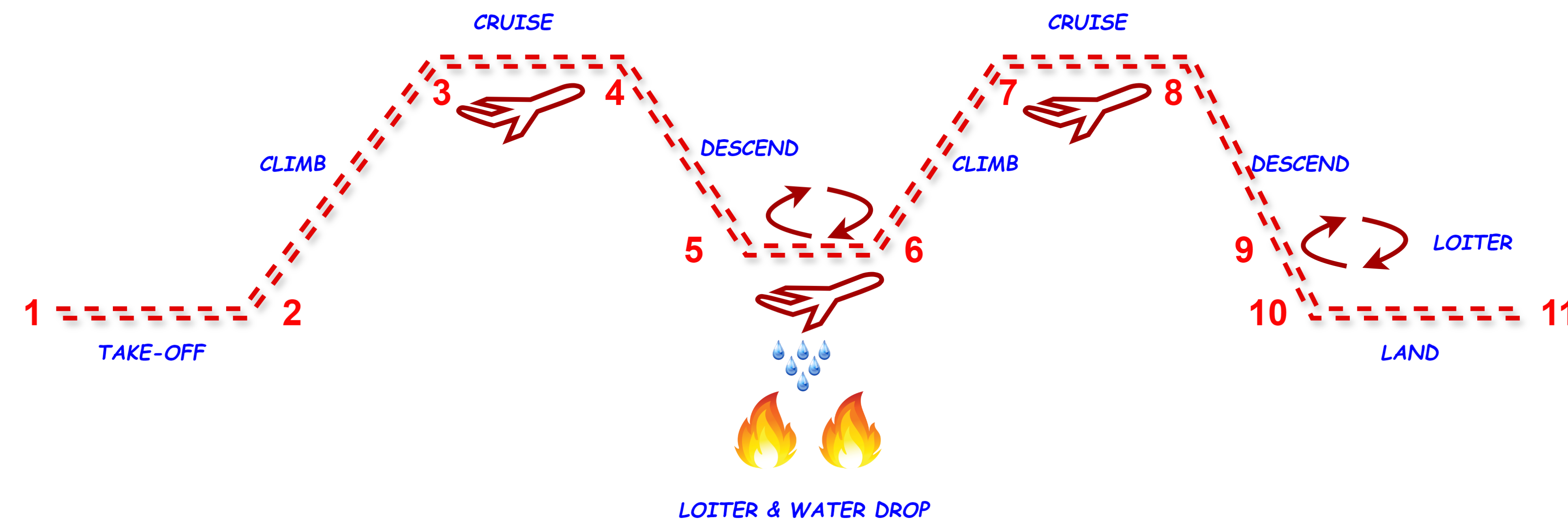
## Design Requirements

- ✈ Aerial Firefighting Aircraft
- ✈ Capable of operating from a 6000ft length runway
- ✈ Climb to cruise altitude (minimum 6000ft)
- ✈ 120nm cruise to the scene of the fire
- ✈ 30 min loitering endurance
- ✈ Water-drop at the fire scene
- ✈ 120nm cruise (minimum 6000ft) to a recovery airfield
- ✈ 30 min holding endurance ( At 2000ft)
- ✈ Landing with VFR fuel reserves
- ✈ Short range cargo as secondary mission when aircraft is not in use
- ✈ Maximum air drop speed 130 knots

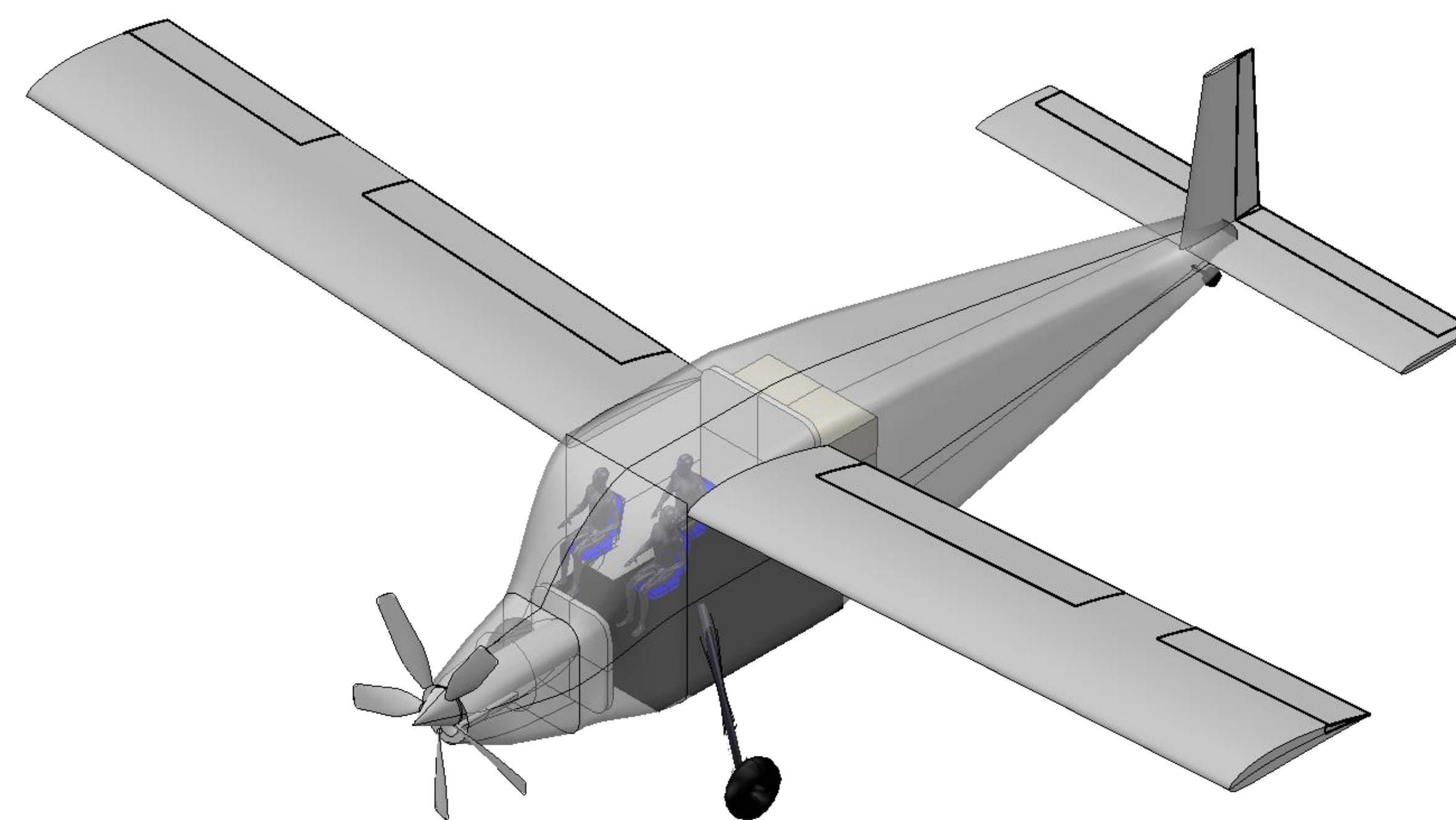
## Aircraft Configuration

- ✈ Tractor Configuration
  - ✈ Provides operational Versatility,
  - ✈ Safeguards engine from chemical/water being sprayed.
- ✈ High Wing
  - ✈ Better visibility while searching for wildfire zones.
  - ✈ Improved stability and control, especially at low altitudes, common in water-dropping missions
  - ✈ Faster loading/unloading and easier integration of drop systems
- ✈ Tail Dragger
  - ✈ Shorter takeoff and landing, beneficial for water-dropping missions.
  - ✈ Suited for operations from unpaved or rough airstrips, typical in firefighting and water-dropping missions
- ✈ Fuselage ( Tubular / Tube & Wing)
  - ✈ More payload capacity.
  - ✈ Sufficient cockpit space for pilot, copilot and loadmaster.
  - ✈ Allows reconfiguration between the water-bombing role and the cargo / air-drop role.

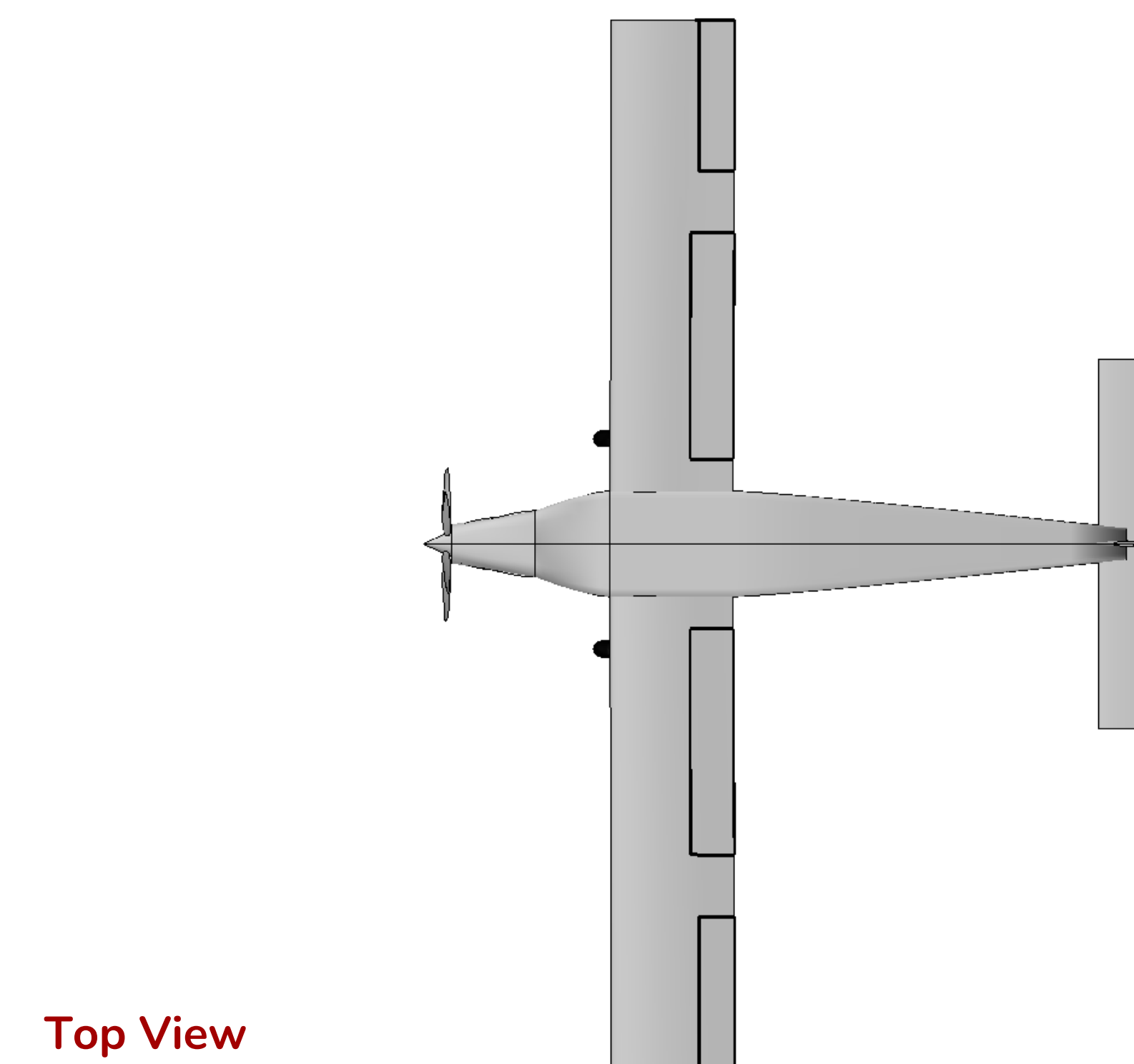
## MISSION PROFILE



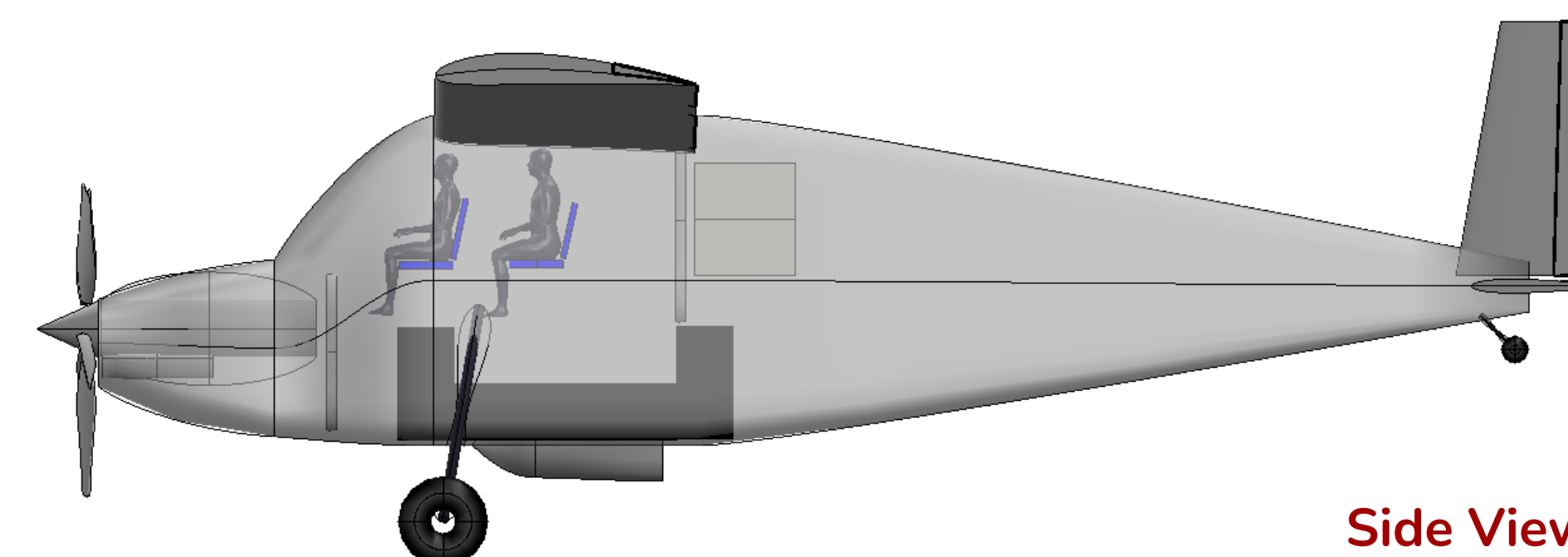
## AIRCRAFT LAYOUT



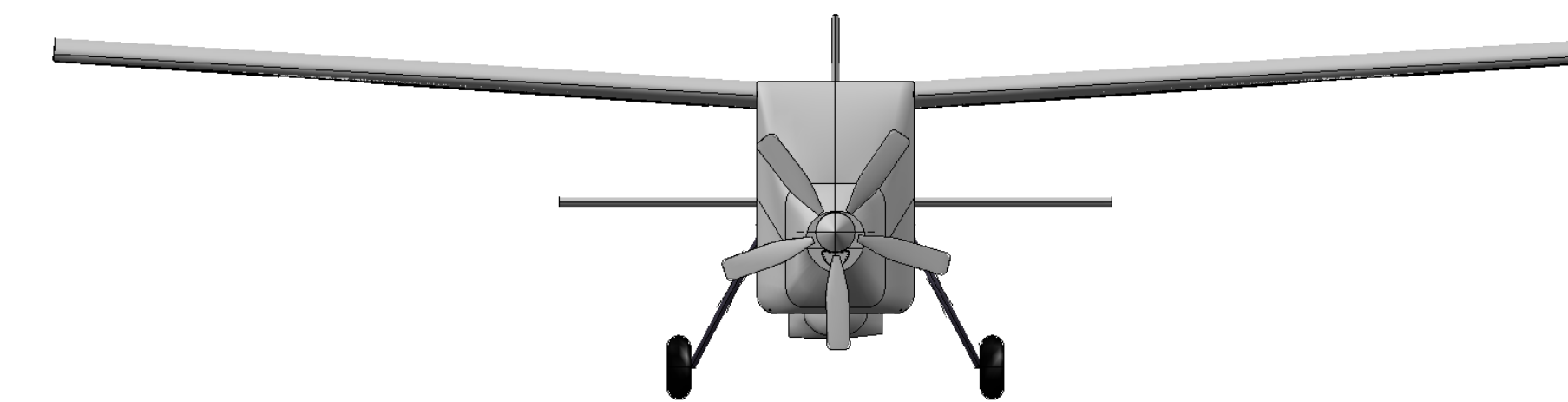
Isometric View



Top View

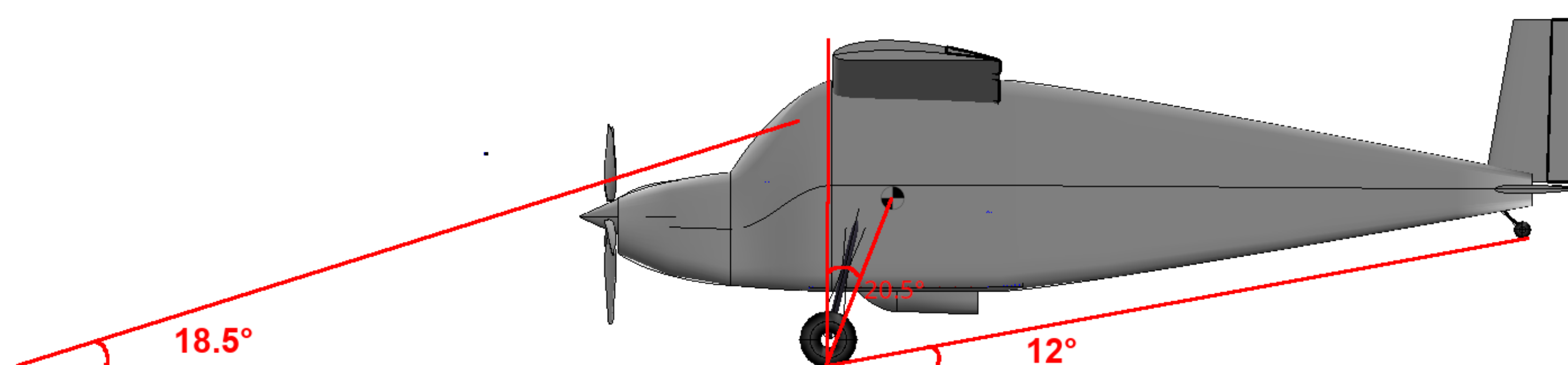


Side View



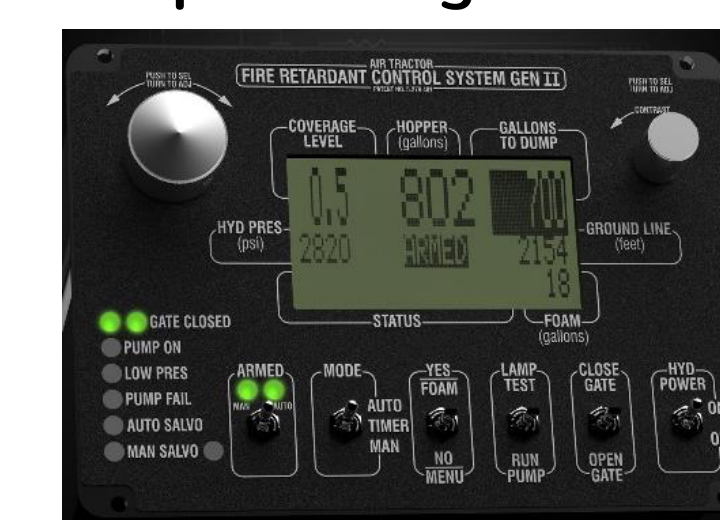
Front View

## PILOT LOS & TIP-BACK ANGLE



## LOADING & DROP SYSTEM

- ✈ Water Fill rate about 300 gallon/min with 1.5 inch hose diameter
- ✈ GEN II Fire Retardant Drop System (FRDS)
- ✈ Max. drop of 925 gallons in 2 s



## SPECIFICATIONS

PARAMETERS	VALUES
MTOW	8600.5 kg
Range	250 nm
Endurance	2.5 hrs
Stall Speed	85 kts
Cruise Speed	150 kts
Maximum Speed	220 kts
Absolute Ceiling	12000 ft
Payload Weight	3500 kg
Empty Weight	3451.9 kg
Fuel Capacity	1348.6 kg
Powerplant	P&W PT6A-67F
Power	1700 hp
Fuselage Length	13.4 m

## WING & TAIL SIZING

SURFACE	WING	HORIZONTAL TAIL	VERTICALL TAIL
Airfoil	NACA 4412	NACA 0012	NACA 0012
Span (m)	19.89	7.03	4.54
Area (m <sup>2</sup> )	46.57	8.72	2.38
AR	8.5	5.66	8.65
Incidence	2°	-2°	0°
Taper Ratio	1	1	0.62

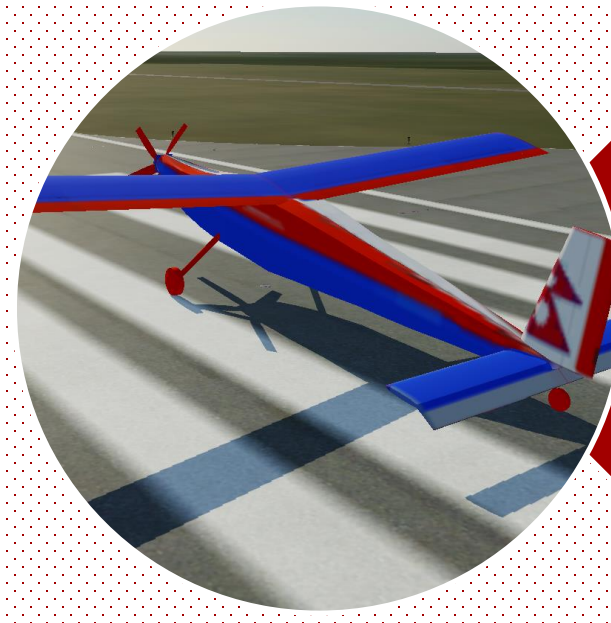
## CONTROL SURFACE SIZING

Control Surfaces	% of MAC	% of Span	Deflection (deg)
Aileron	25	30	-25 to 35
Elevator	40	90	-30 to 35
Rudder	35	100	-25 to 25
Flap	30	40	0 to 25

## WATER DROP TEST VIDEO





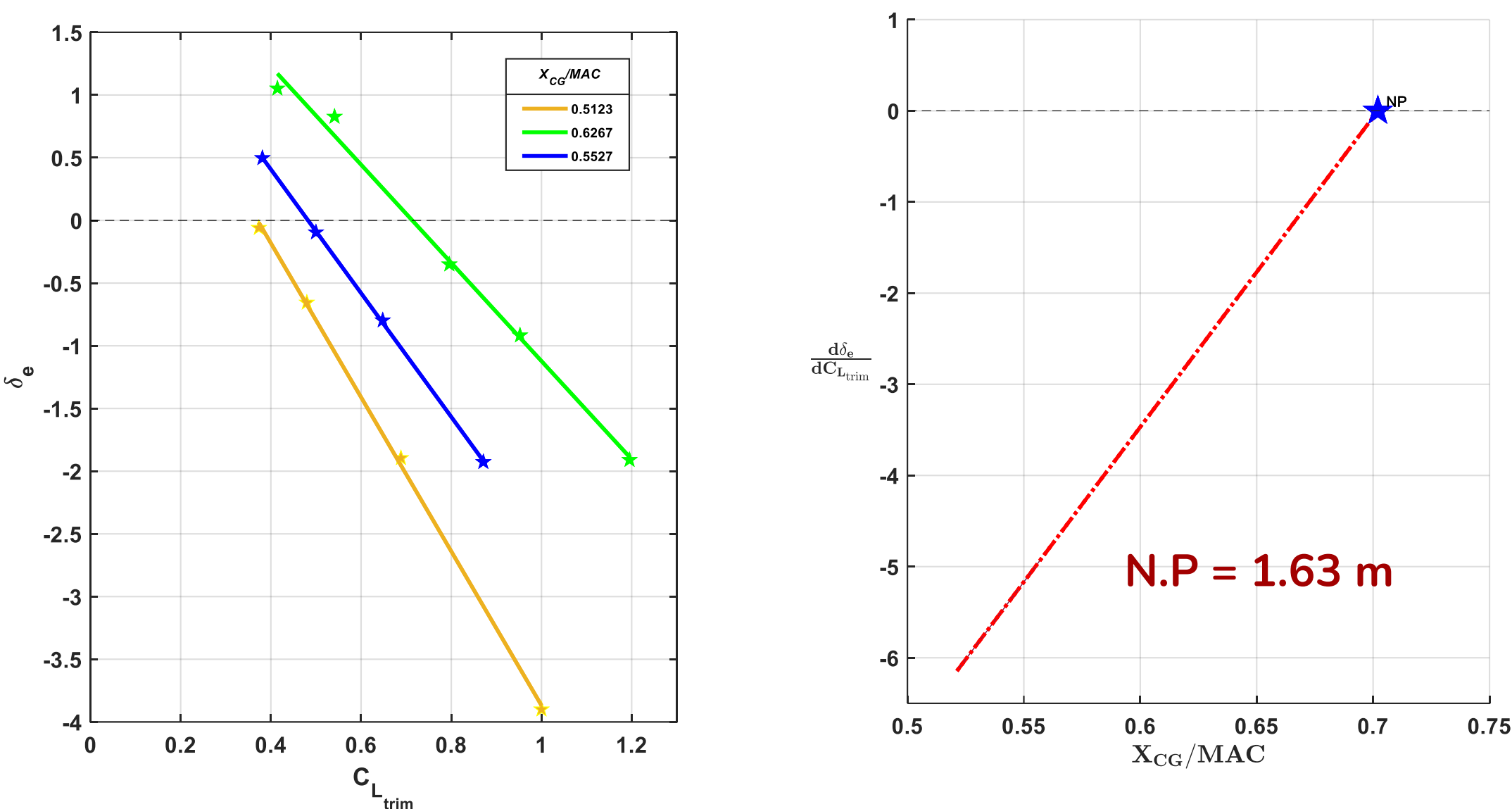


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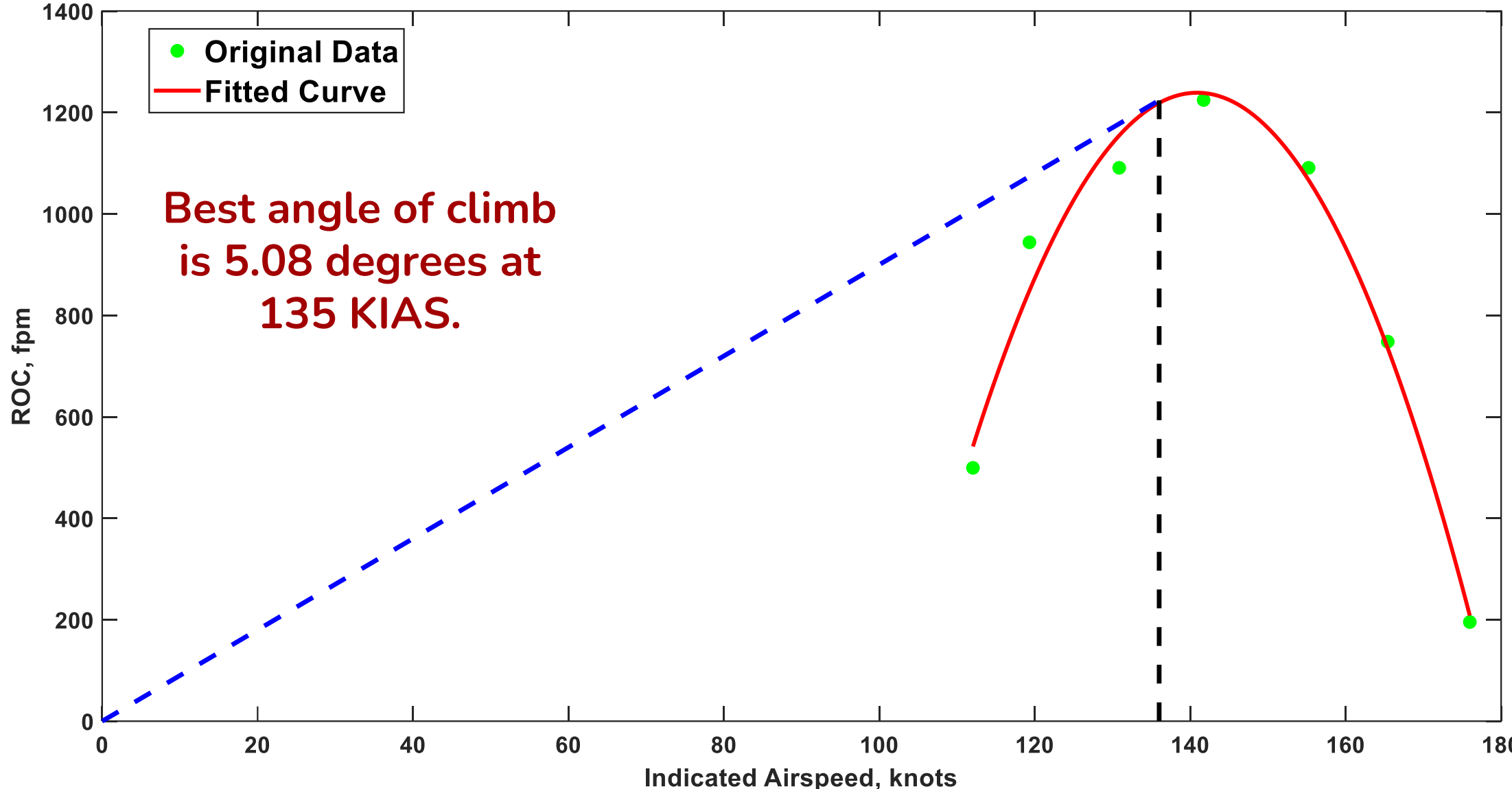


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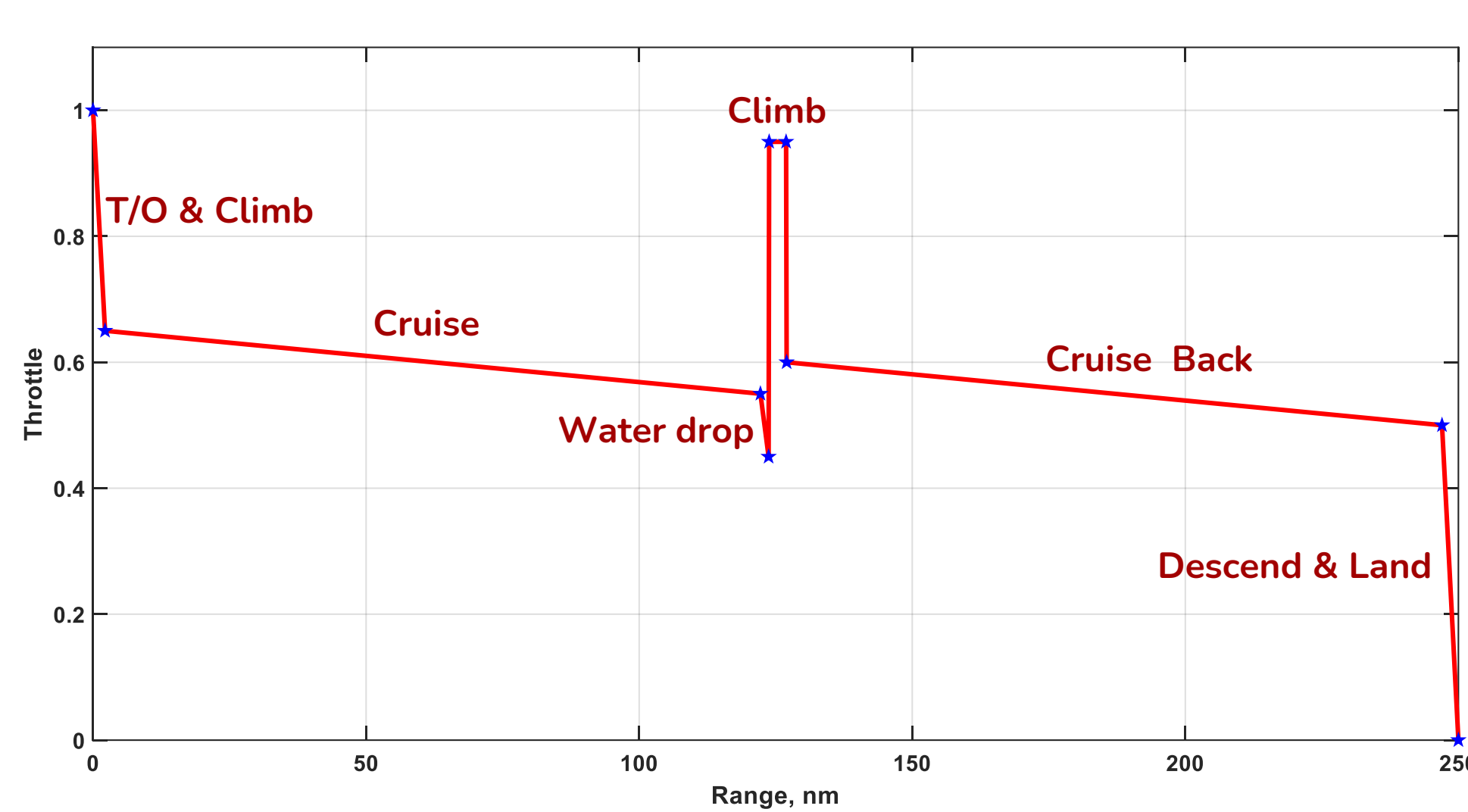
## DETERMINATION OF NEUTRAL POINT



## RATE OF CLIMB (ROC)



## THRUST MATCHING



## DUTCH ROLL & PHUGOID MODE

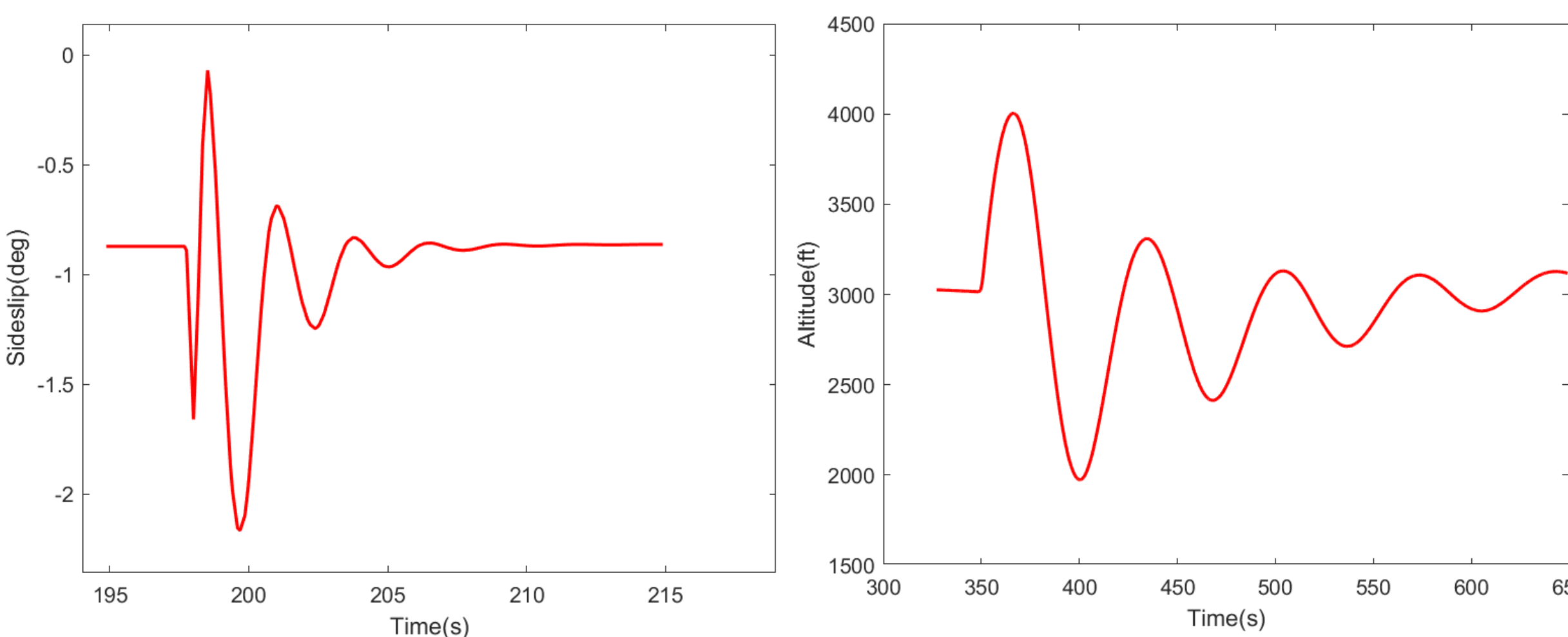
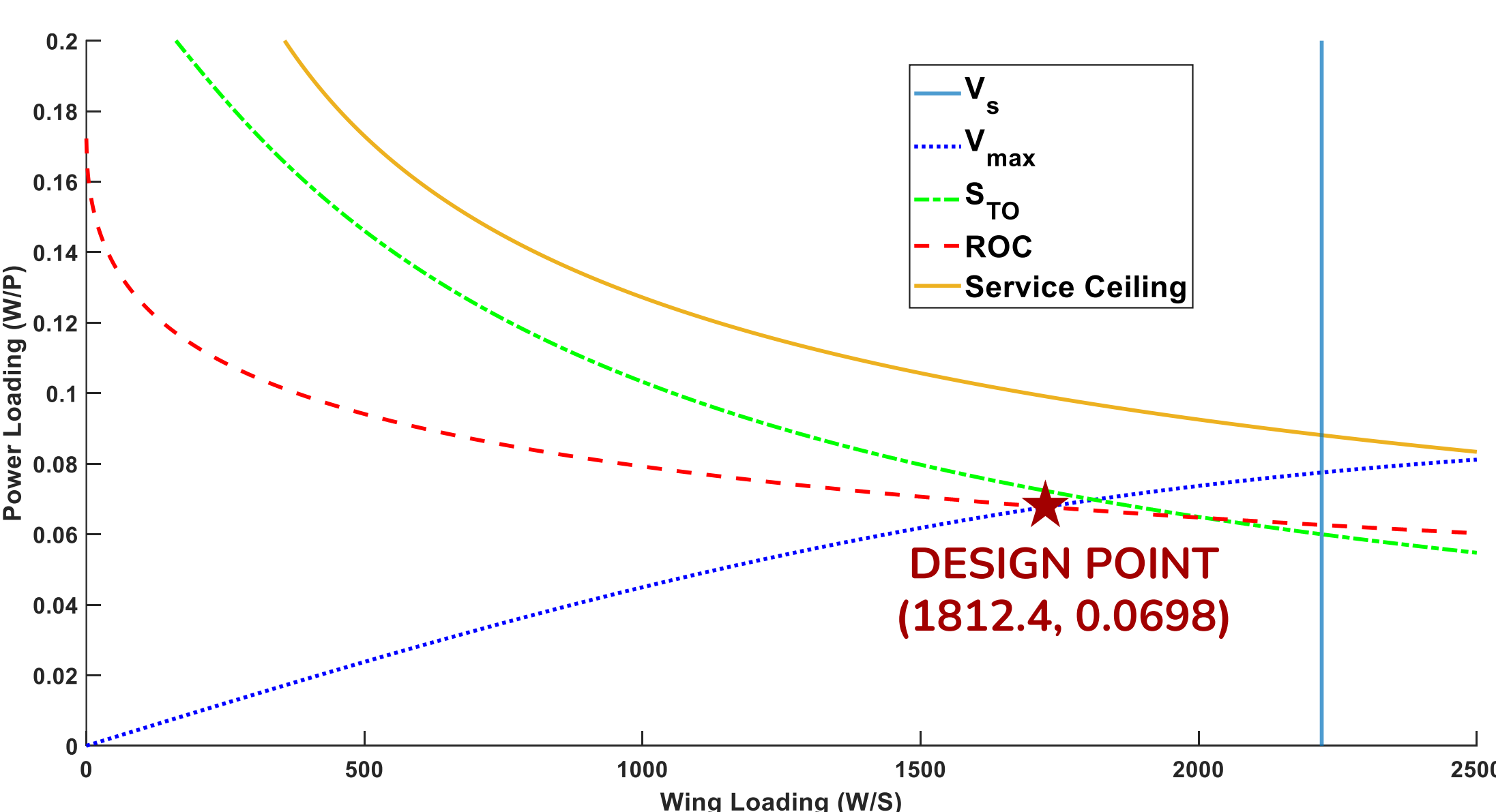


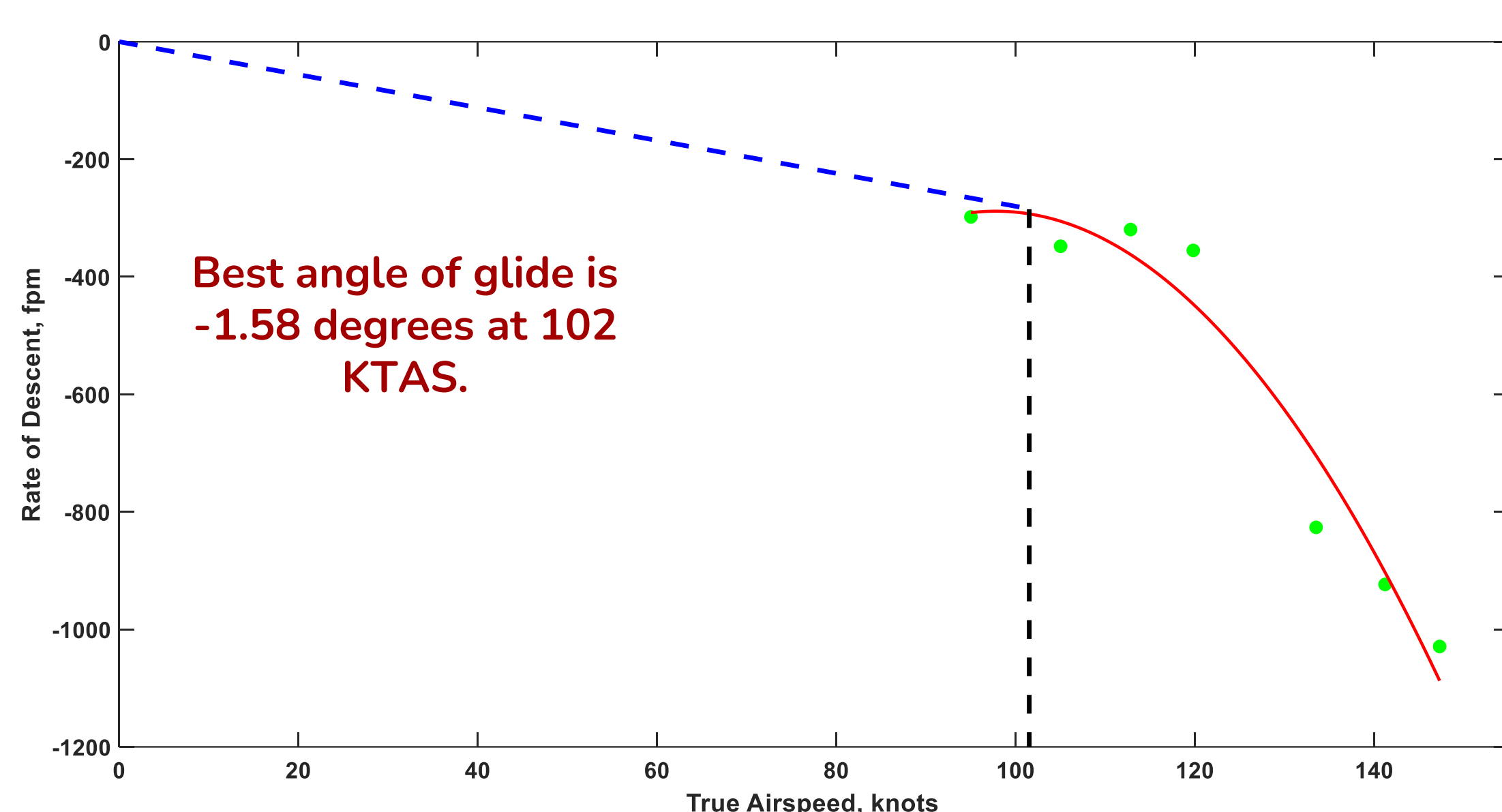
Fig: Dutch Roll

Fig: Phugoid mode

## MATCHING PLOT



## RATE OF DESCENT (ROD)



## SHORT PERIOD & SPIRAL MODE

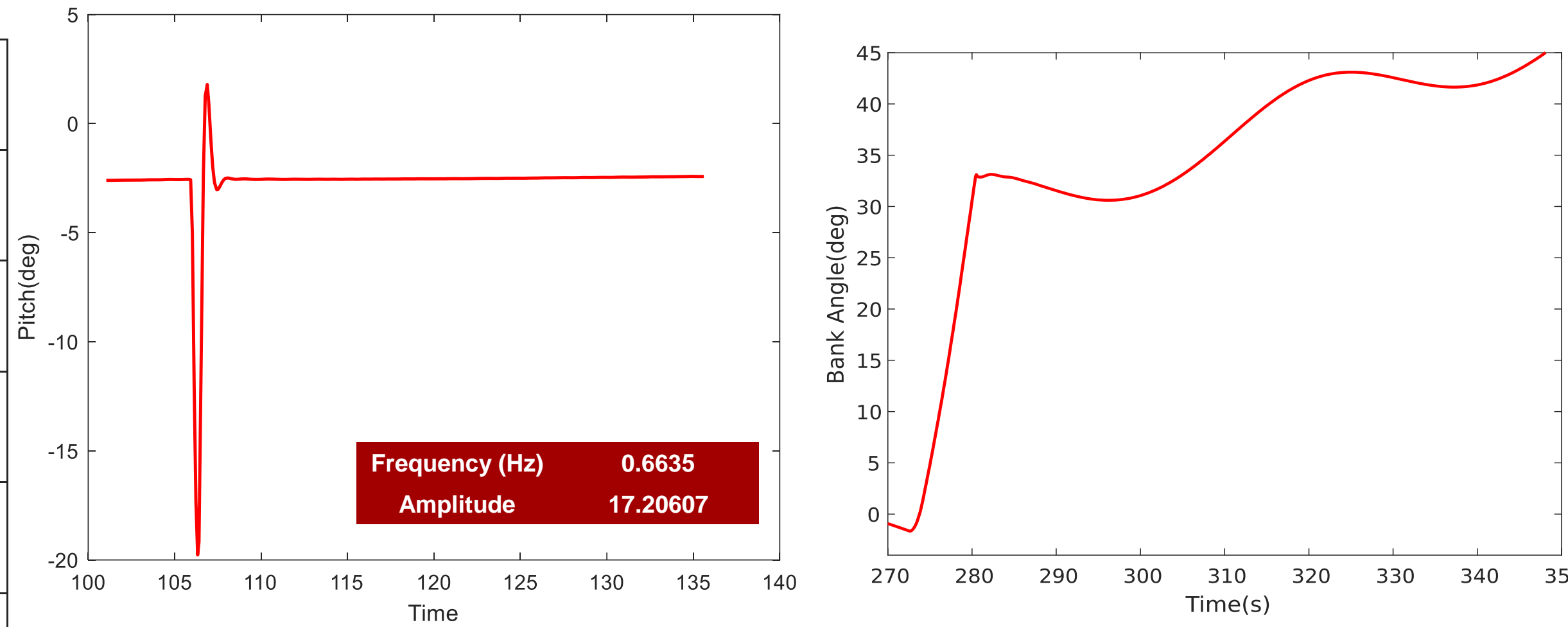


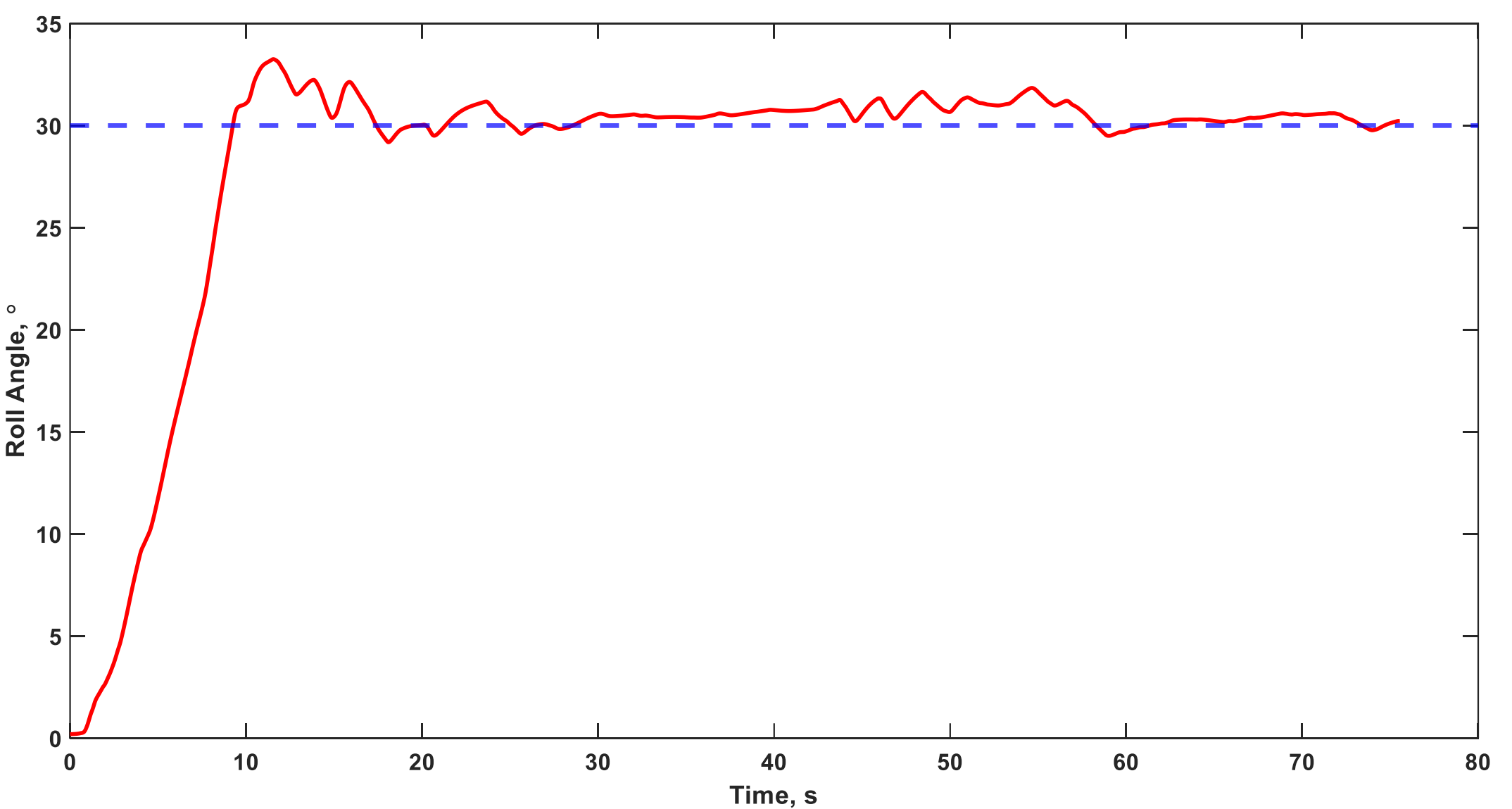
Fig: Short Period

Fig: Spiral Mode at 30°

Frequency (Hz)	0.36
Amplitude	1.297
Damping Ratio (%)	0.246
Subsidence Ratio	4.946

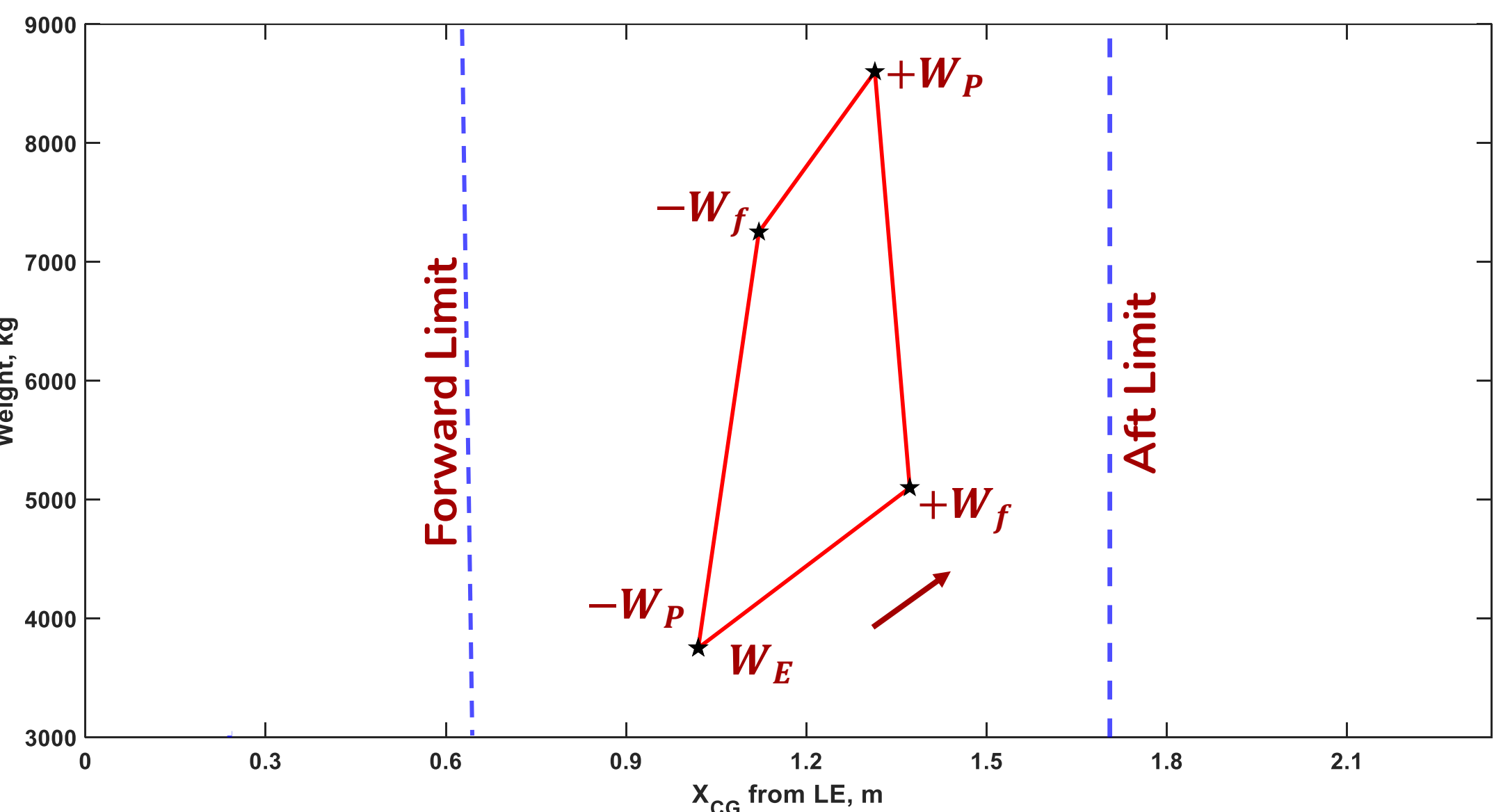
Frequency (Hz)	0.01467
Amplitude	4000.36
Damping Ratio	0.189
Subsidence Ratio	3.35

## HANDLING QUALITY TEST

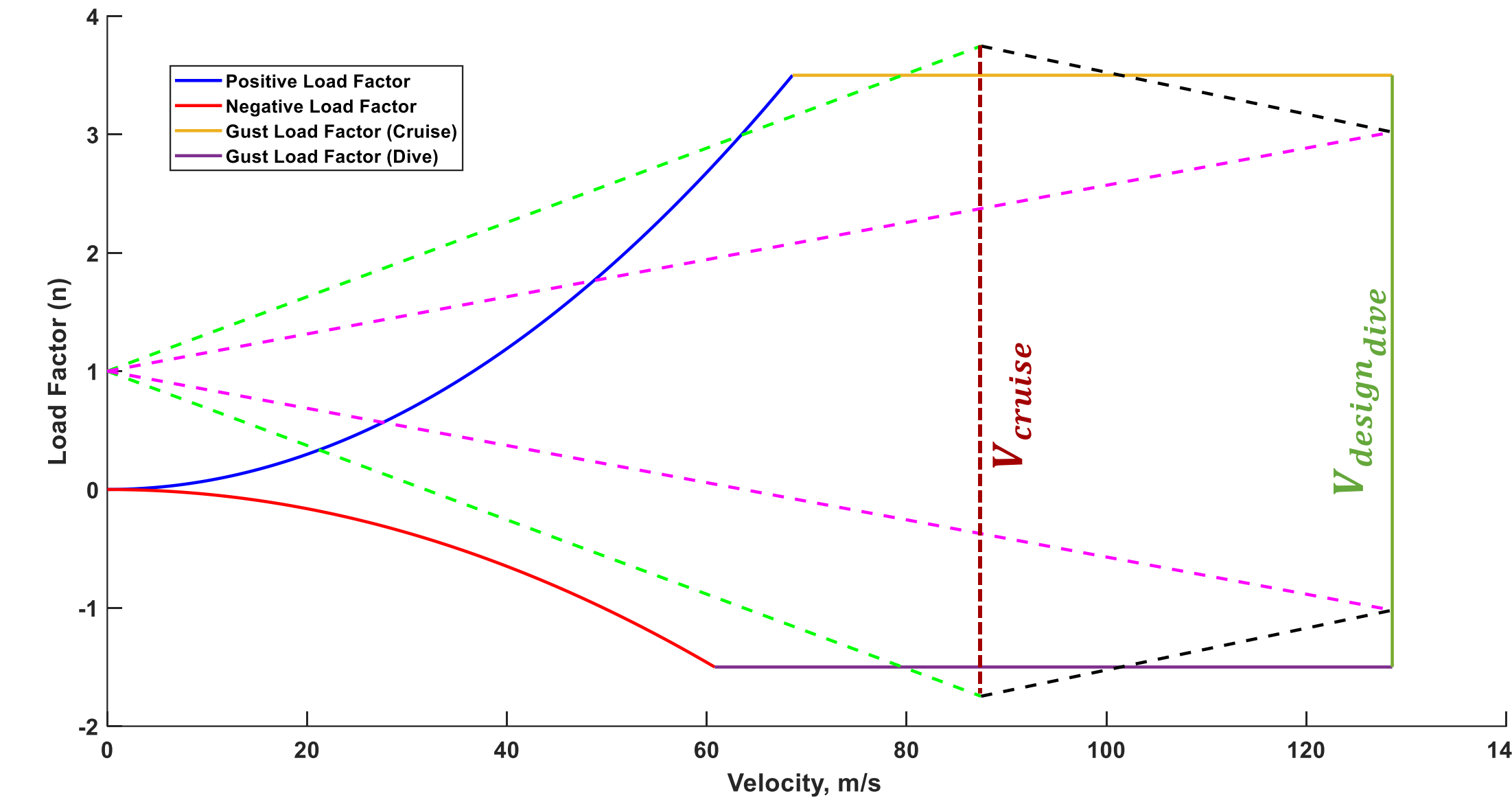


"Based on the Cooper-Harper Rating Scale (CHRS), our firefighting aircraft demonstrates satisfactory handling characteristics and can be effectively controlled within a specified range of pitch and roll variations. The pilot is required to put in moderate effort to maintain precision, especially during demanding maneuvers such as low-altitude water drops. Thus, we assign a Cooper-Harper rating of 4 to our aircraft."

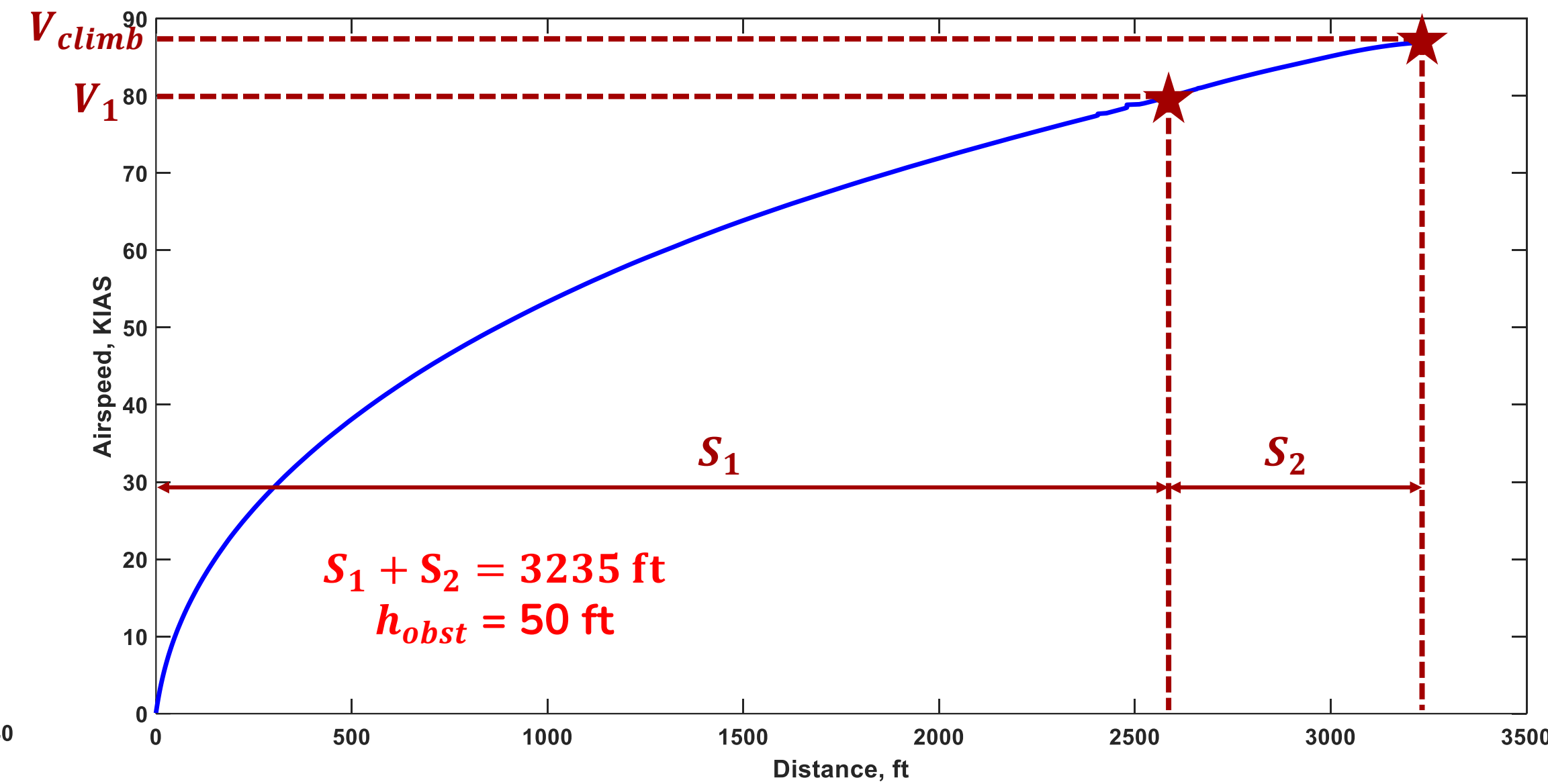
## CG ENVELOPE



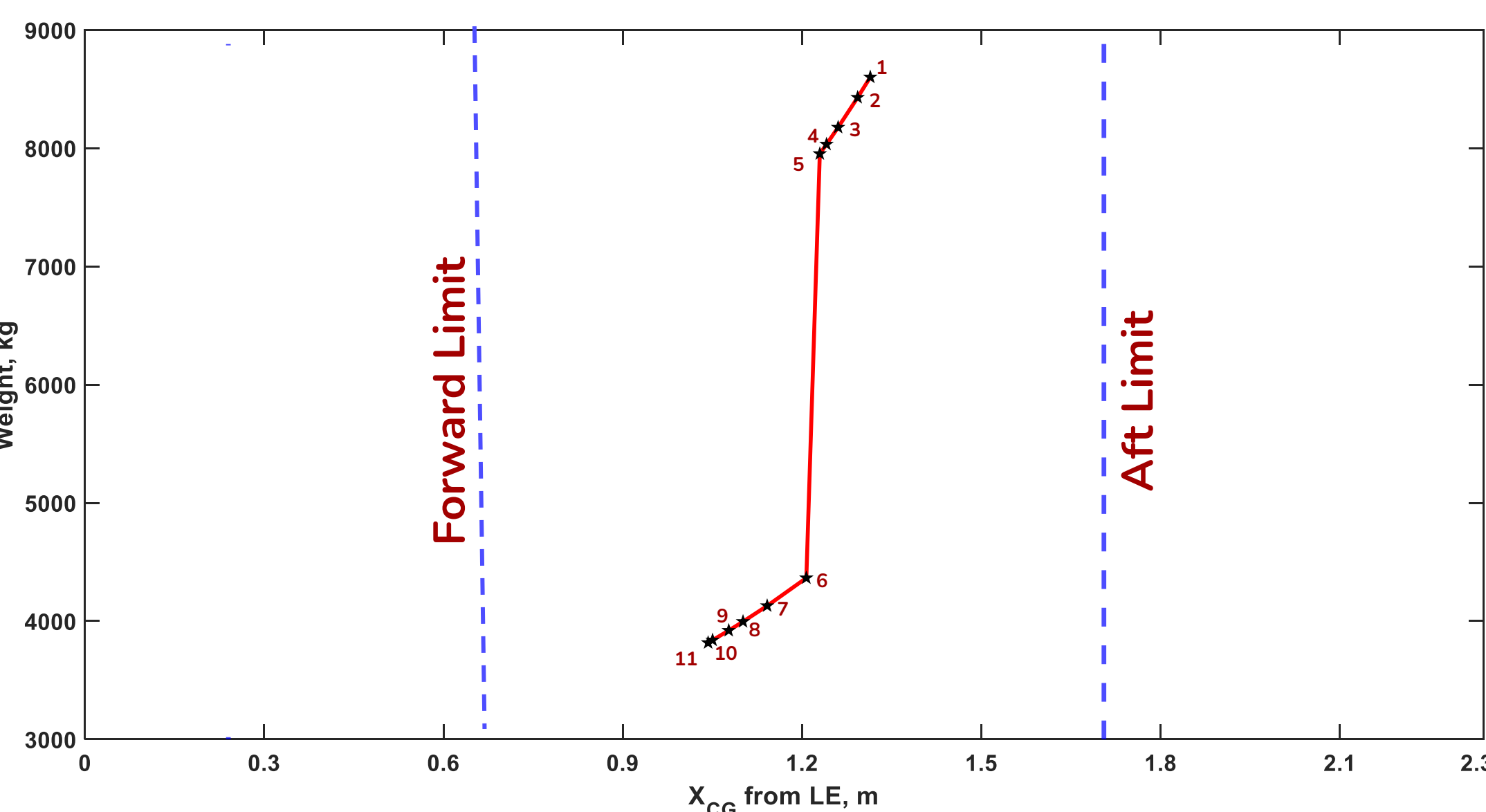
## FLIGHT & GUST ENVELOPE



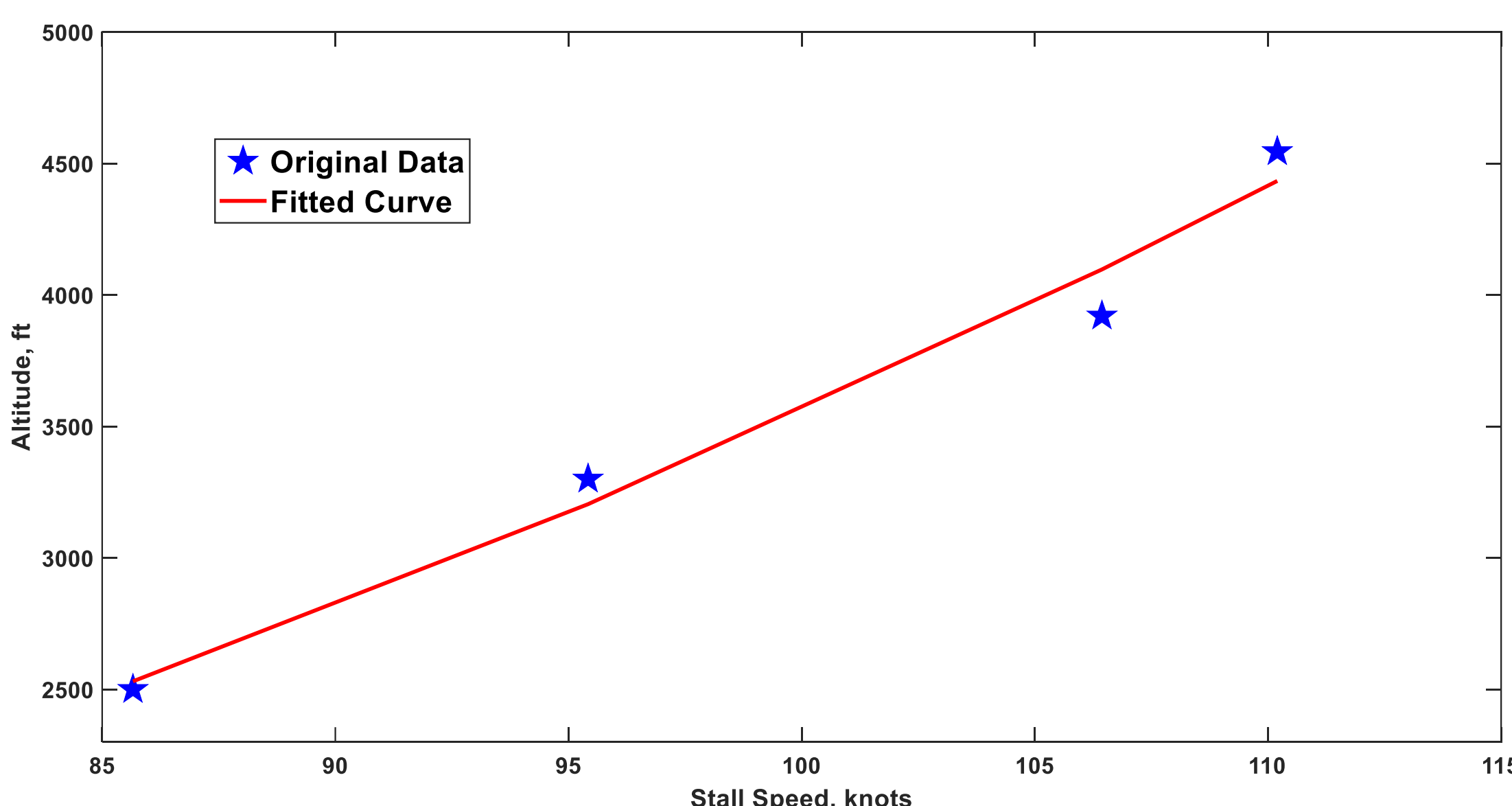
## TAKE-OFF PERFORMANCE



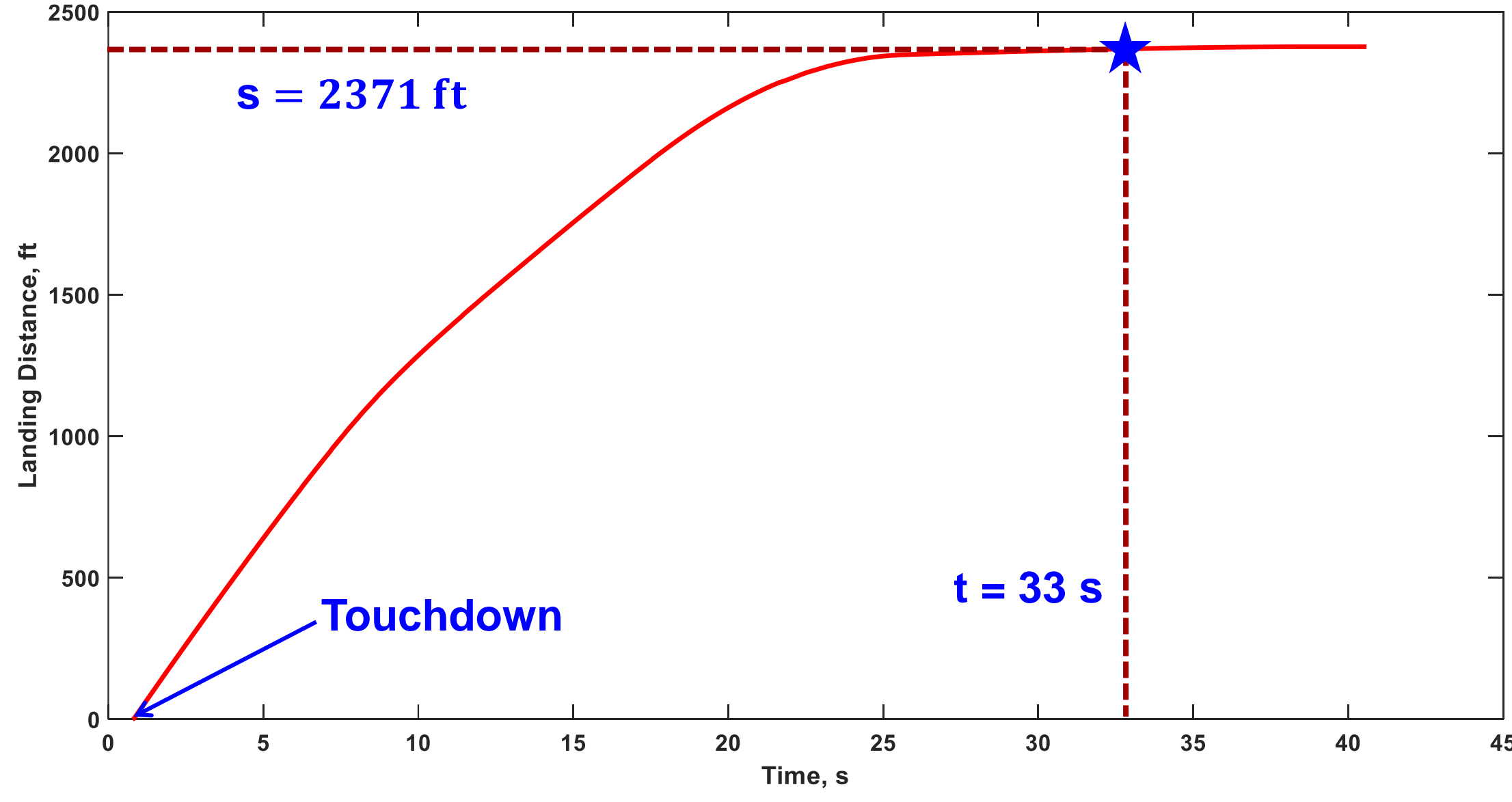
## CG TRAVEL



## STALL CHARACTERISTICS



## LANDING PERFORMANCE



## CONCLUSION

"Preliminary flight tests of Wildfire Warrior concluded that we achieved our design requirements of Range (250 nm) and Endurance of 2.5 hrs. We were also able to perform low altitude water drops at the fire scene effectively. The aircraft also exhibits good static and dynamic stability, with minor improvements required to further reduce yawing tendency and enhance handling qualities."