

# SPLOOSH- The Amphibious Passenger Carrier

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## Introduction

**SPLOOSH** is a specialized amphibian twin otter aircraft that can operate off water and are completely independent of regular land-based airfields. The twin floats allow to take off and land on water surfaces which makes it perfect for accessing remote locations like lakes, and coastal areas. Besides appealing to adventurers, this amphibian aircraft is very useful from a transport and rescue standpoint. The main objective of this aircraft is to operate on both water and land, improving its versatility.

## Design Requirements

- Takeoff and landing on both land and water.
- Aircraft that can carry 18 passengers and 3 crew members.
- STOL aircraft that can take off from 350 m runway length and land at 450 m runway length.
- Service ceiling of 15,000 ft.
- Cruising altitude of 13,000 ft with cruise speed of 140 knots.
- Stall Speed within 77.75 knots.
- Range of 1000 kms along with 3hrs endurance.
- Statically and dynamically stable aircraft with proper handling qualities.

## Mission Profile

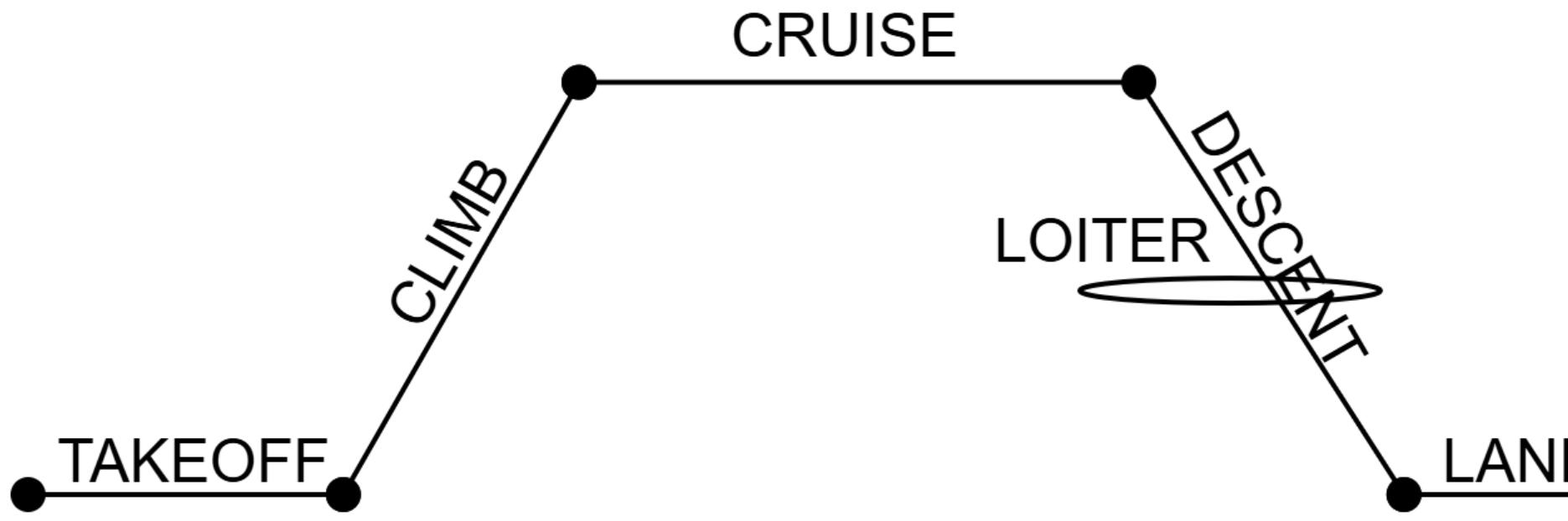


Figure: Mission Profile

## Specifications

### General Specs

Engine Power: 550 hp  $\times$  2  
Range: 1200 Km  
Endurance: 5.2 Hrs  
No. of pax : 18  
No of crew: 3

### Wings

high wing configuration  
Airfoil: SD7062 (14%)  
Span: 20m  
 $C_{root} = C_{tip} = MAC = 2m$   
Aspect Ratio: 10  
Projected Area: 20m<sup>2</sup>  
Dihedral: 3 deg  
incidence: 1deg

### Horizontal Stabilizer

NACA 0012  
Span: 6.3m  
Incidence: -0.5°  
AR=3.95

### Performance

Take-off Length :  
1200 ft (land)  
1600 ft (water)  
Landing Distance :  
1500 ft (land)  
2000 ft (water)  
Cruise Speed : 150Kts  
Cruise Altitude: 12,000 ft

### Control Surfaces

Rudder:  
30% chordwise  
  
Ailerons  
30% chordwise  
100% spanwise

Elevators  
30% chordwise  
20% Spanwise

Flaps  
30% chordwise  
25% Spanwise

### Undercarriage

Length: 41.4 ft.  
Width: 1.76 ft.  
Maximum Height: 4.8 ft.  
Total Buoyancy: 12375 Kg  
Water Rudder : 2sq. Ft

### Landing Gears

Quadricle arrangement  
Steering: Fore Wheel  
Braking: Aft wheel

## Aircraft Design

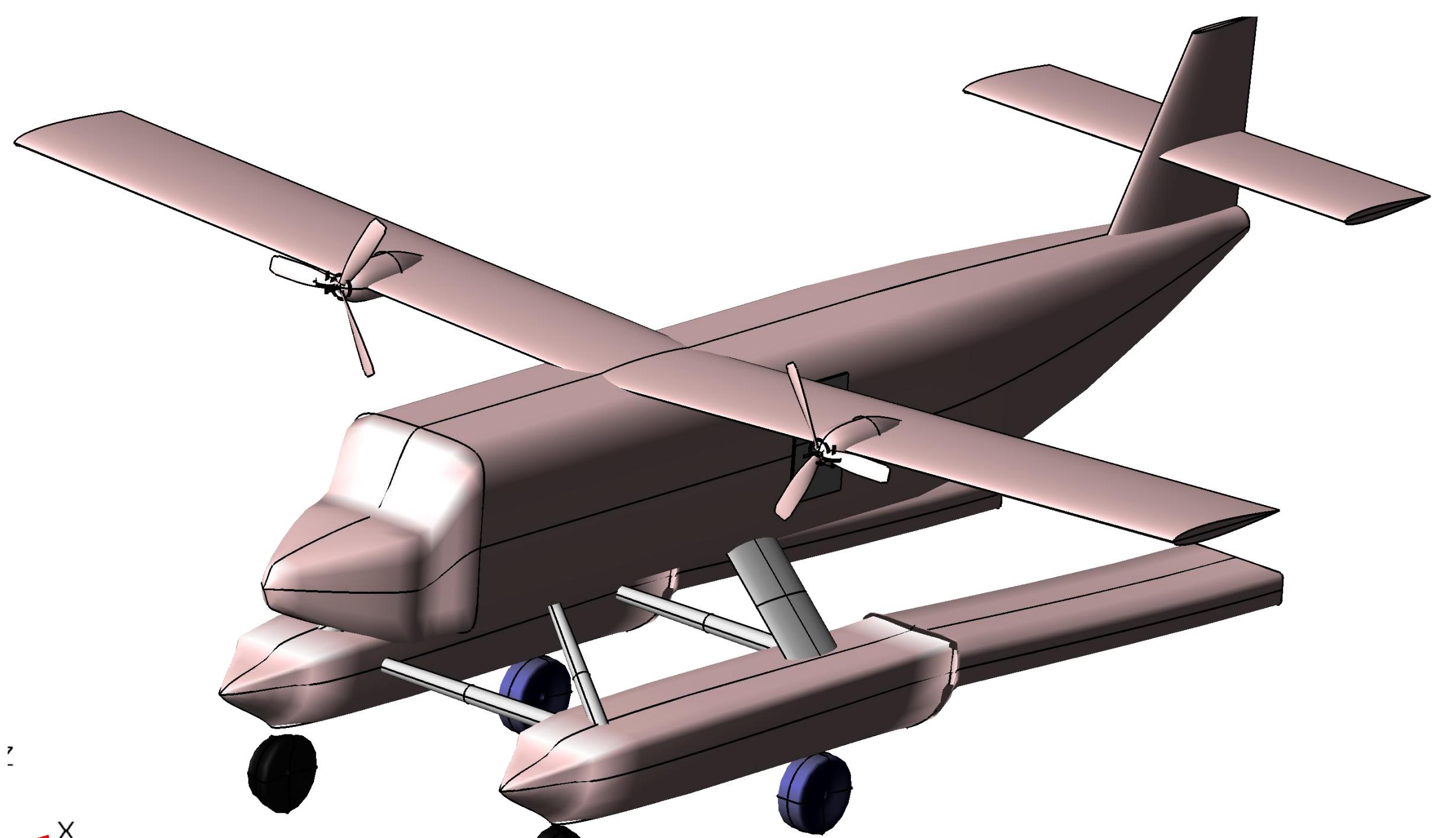


Figure: Isometric View

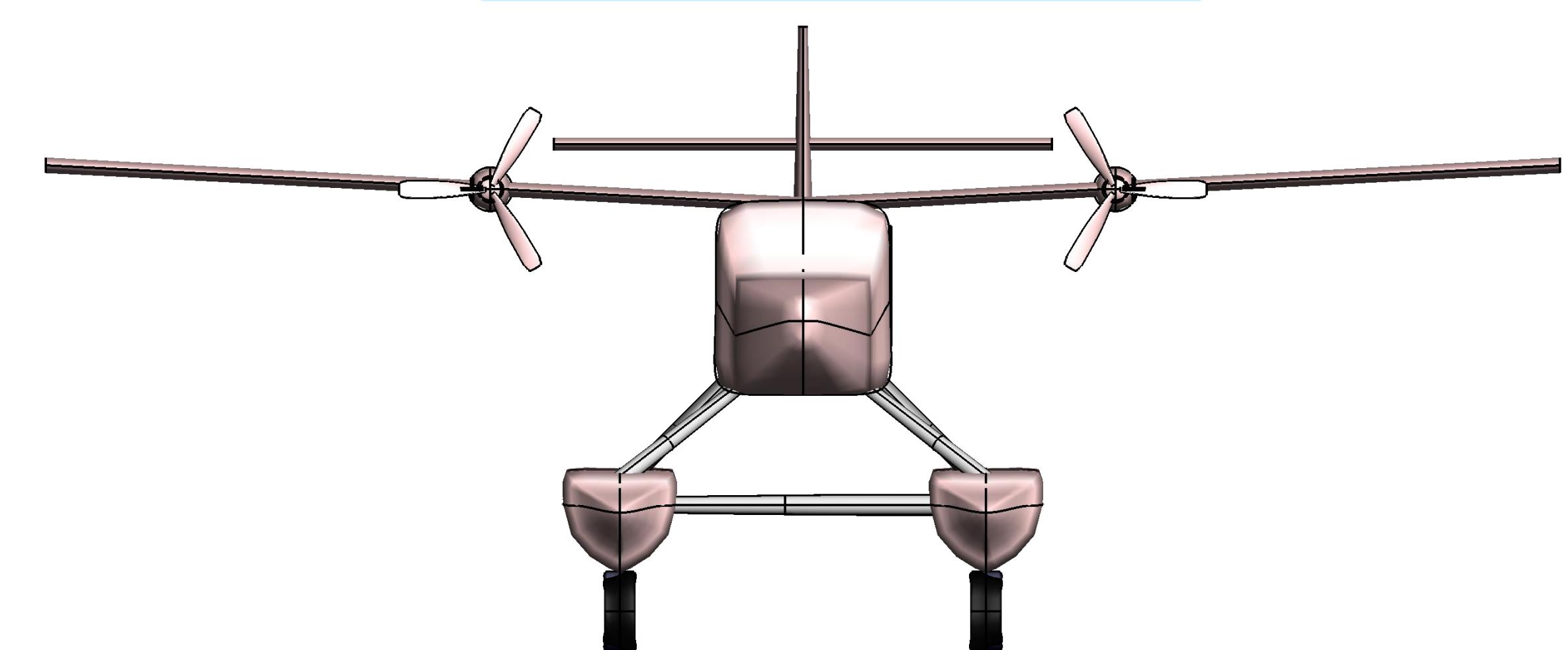


Figure: Front View

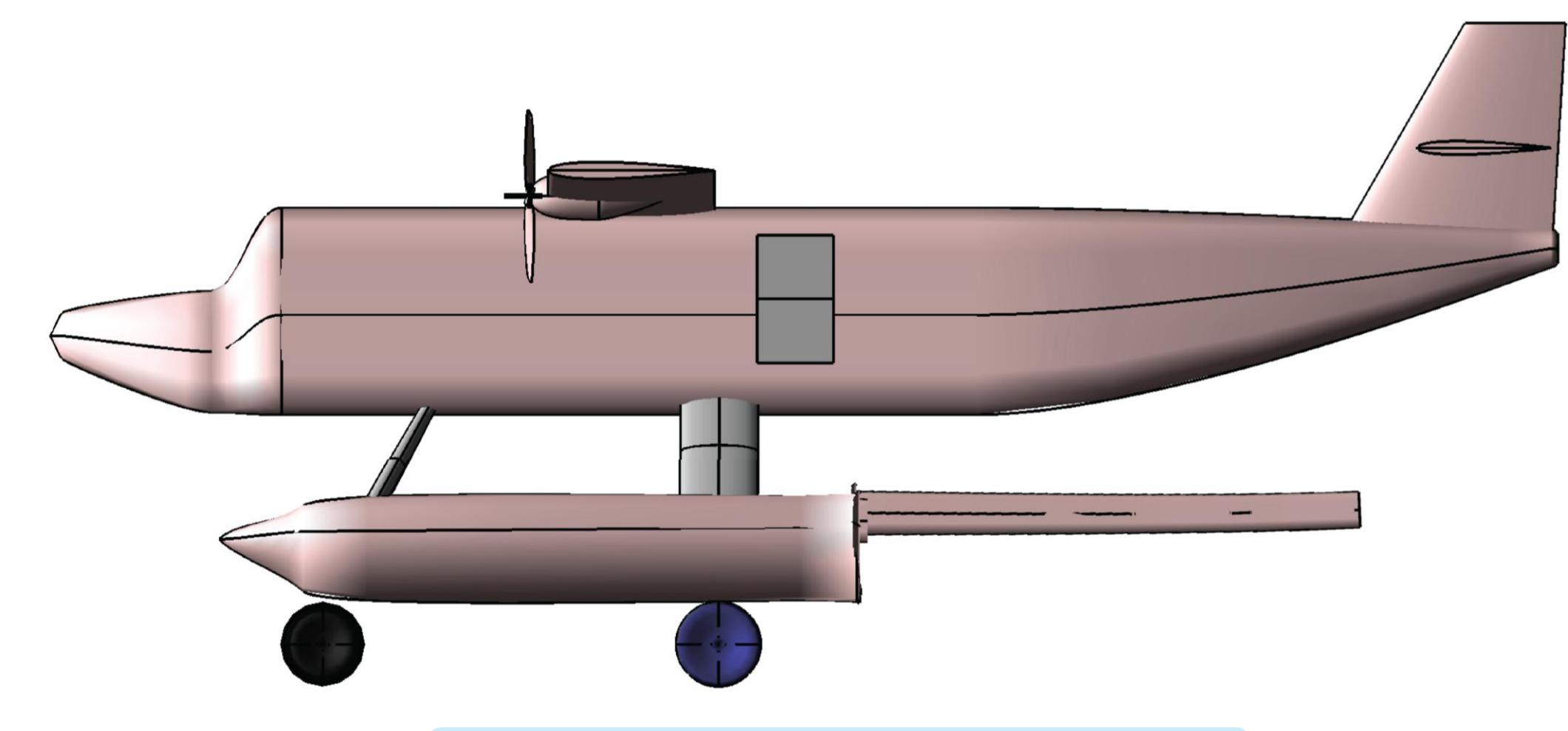


Figure: Side View

## Aircraft Design

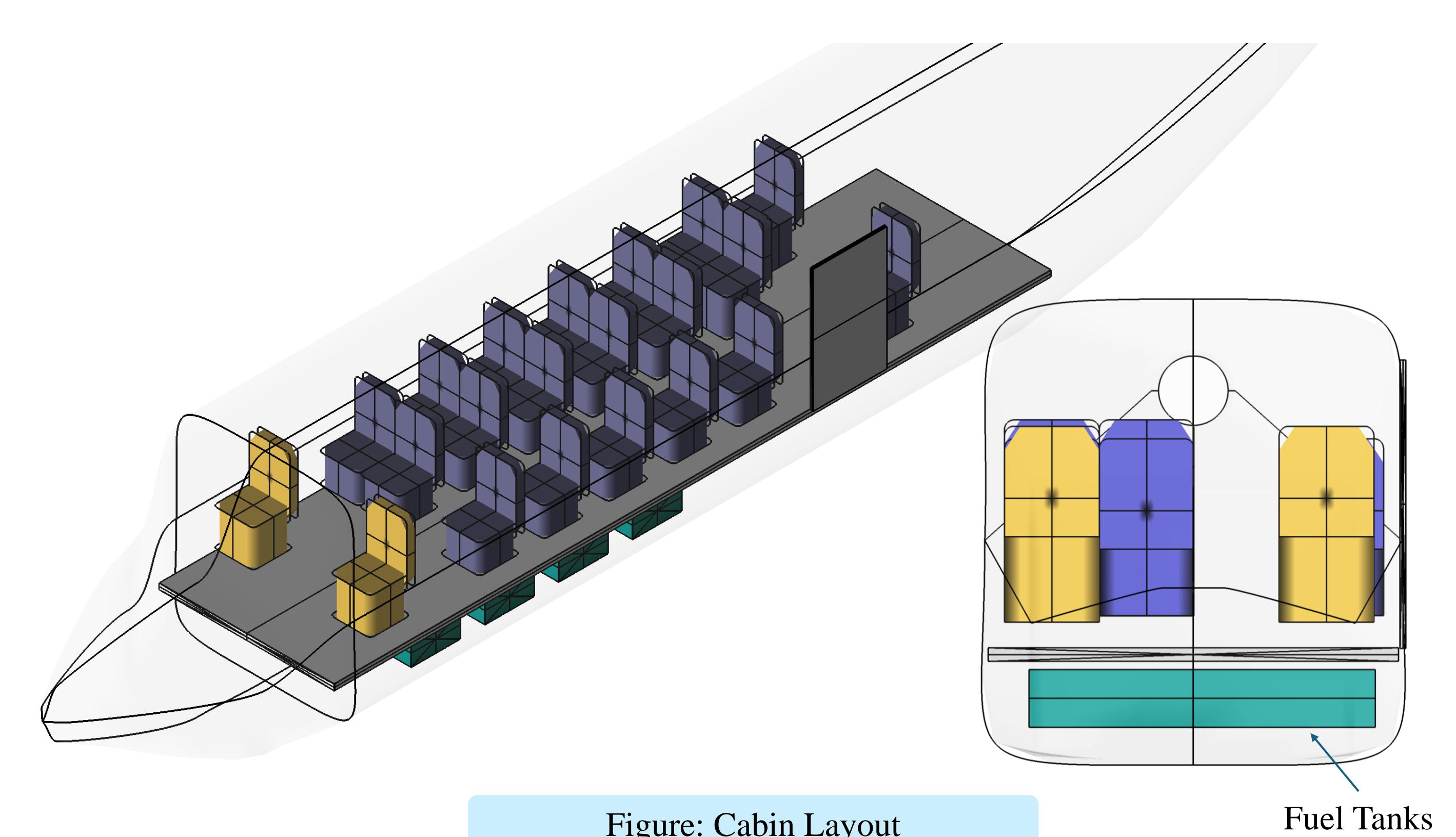


Figure: Cabin Layout

## Matching Plot and Initial Weight Estimation

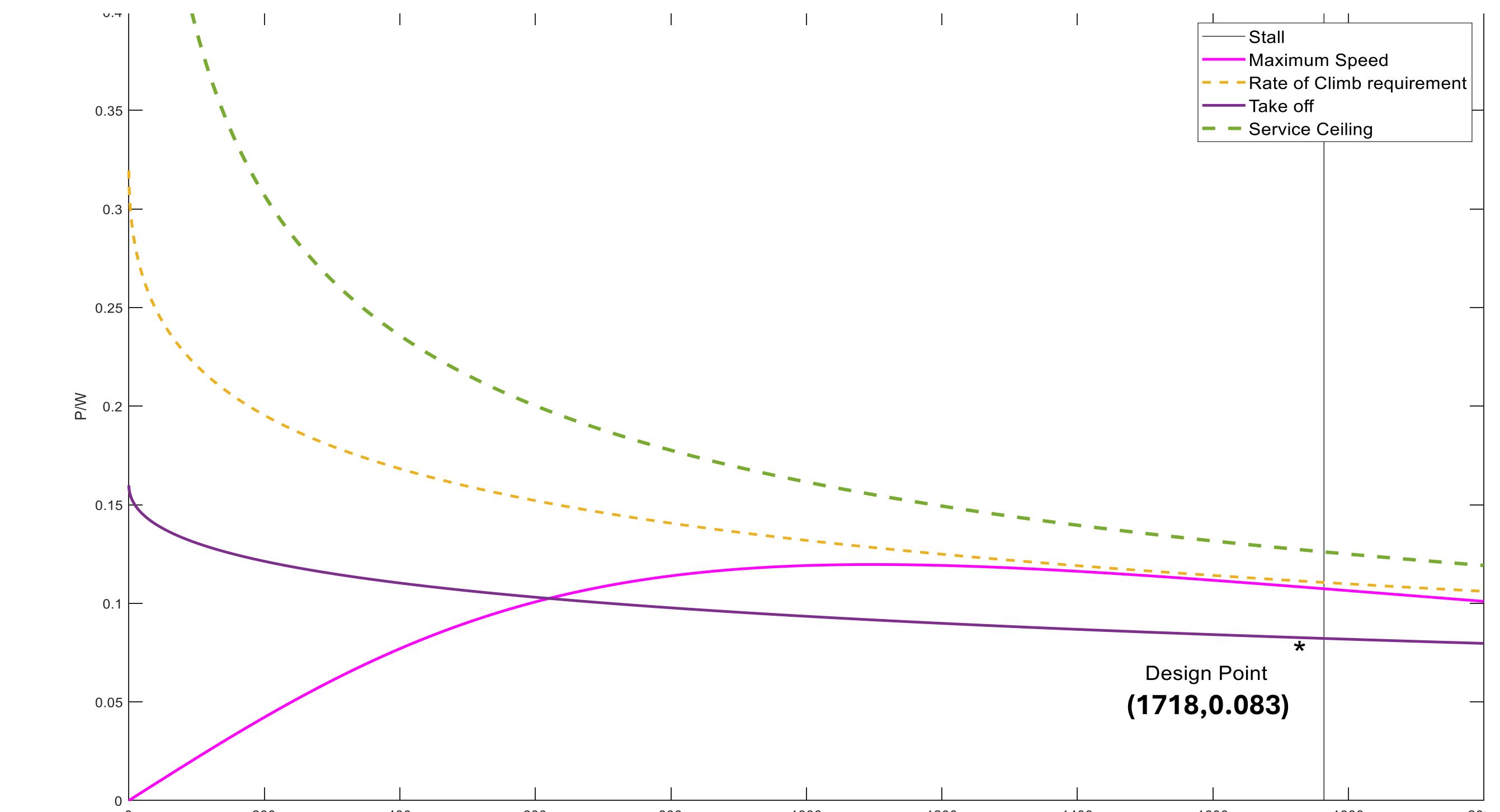


Figure : Matching plot

## Flight Envelope and Gust Envelope

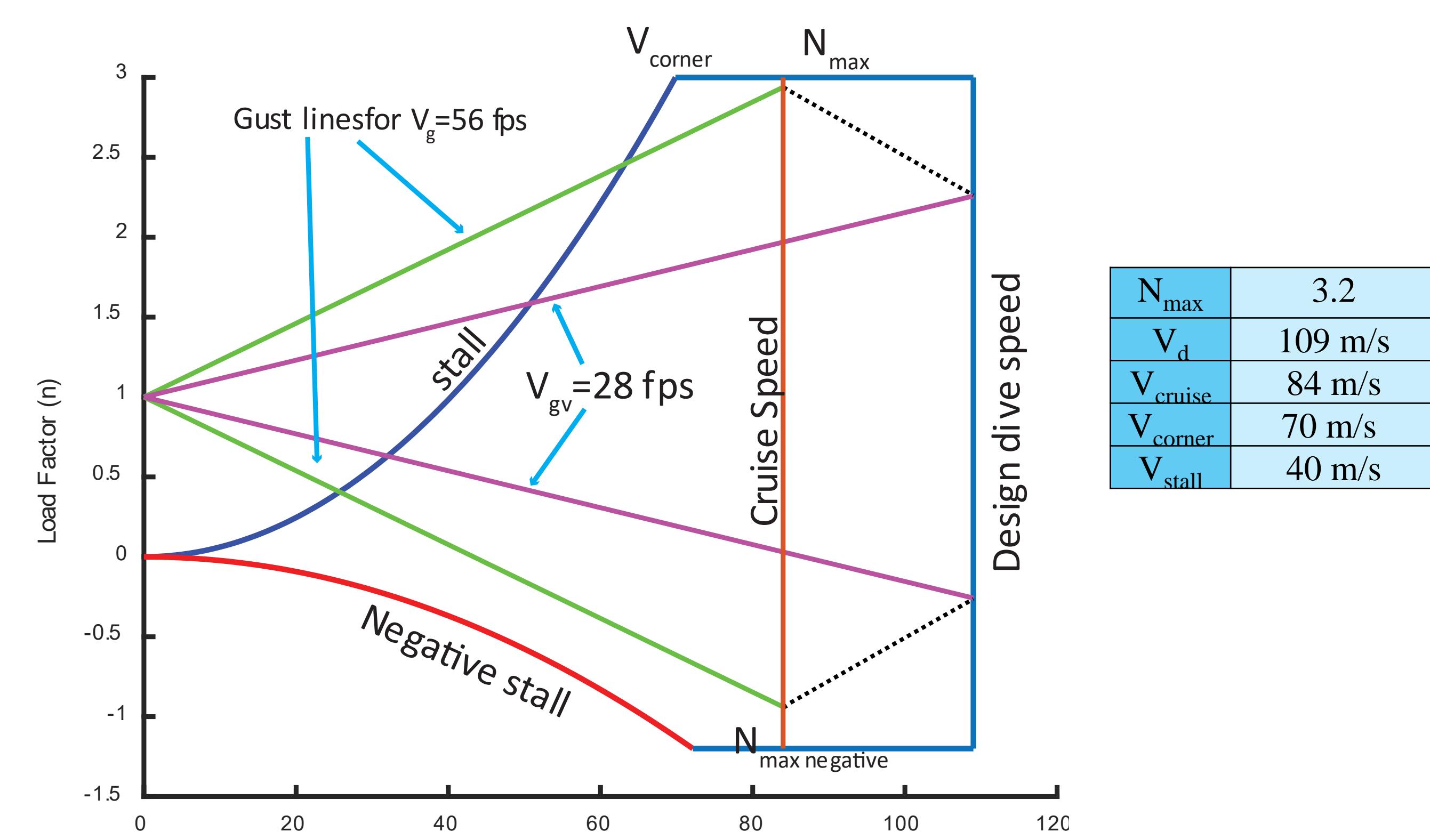
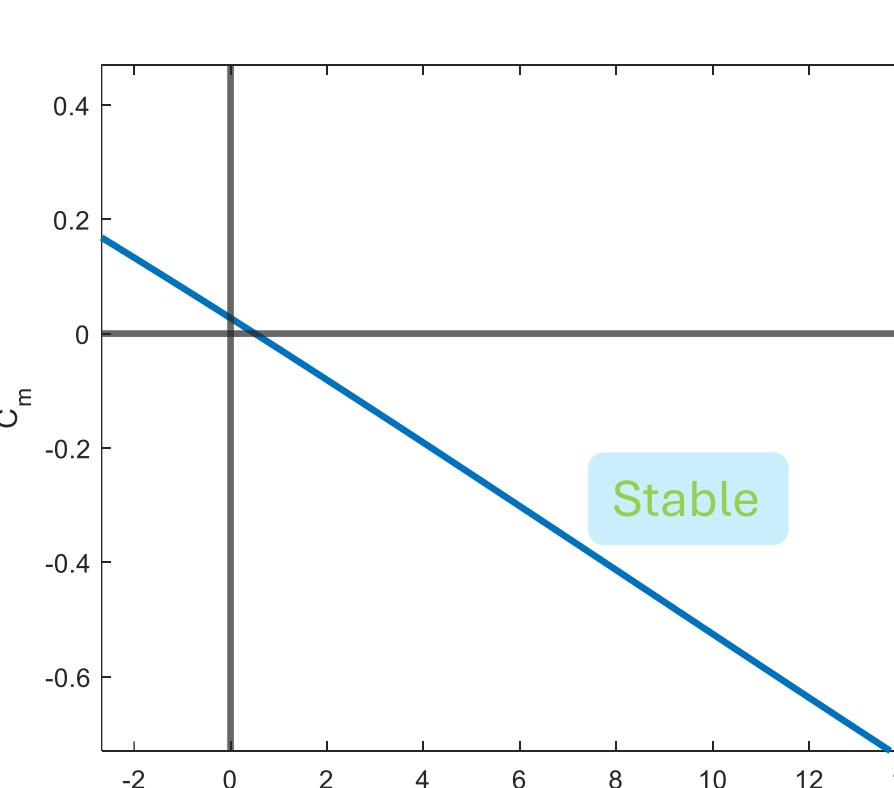
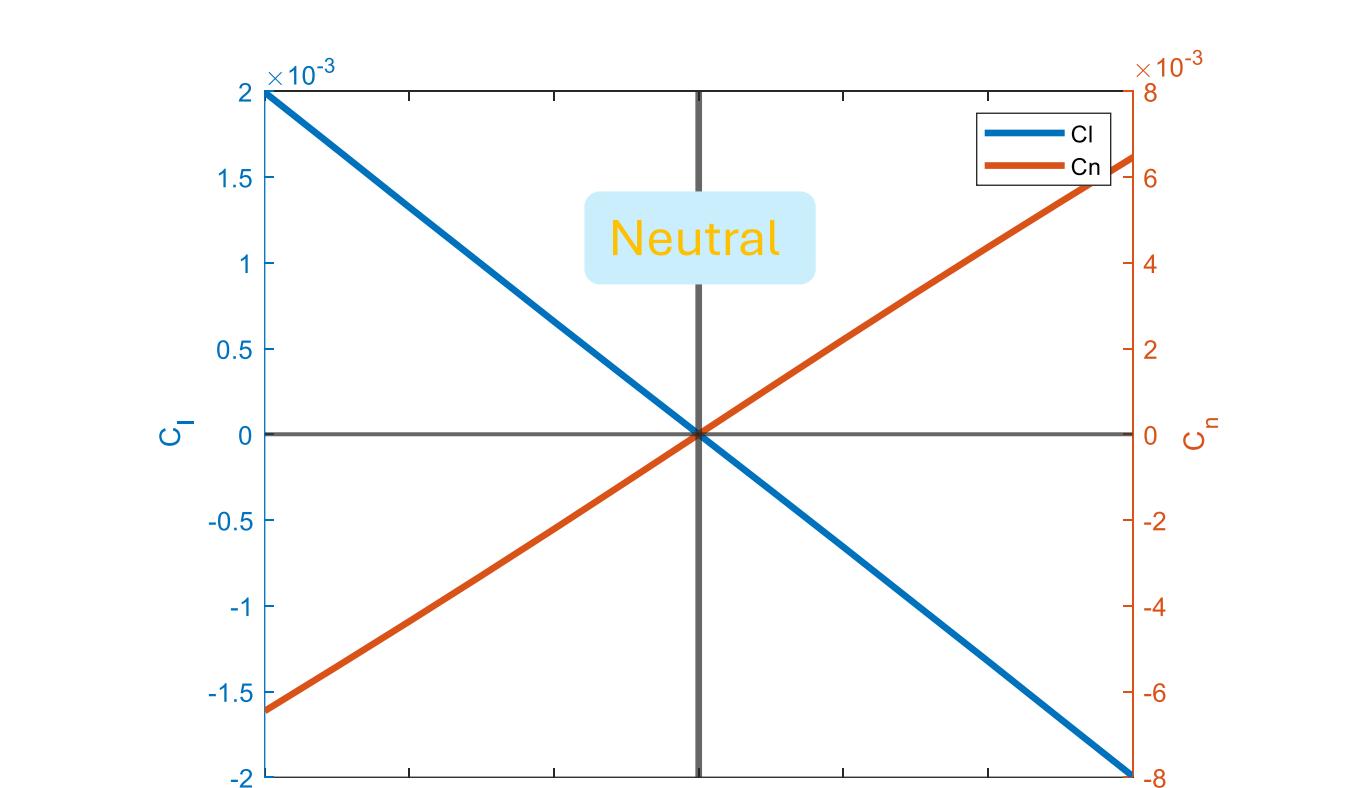


Figure: Gust Envelope

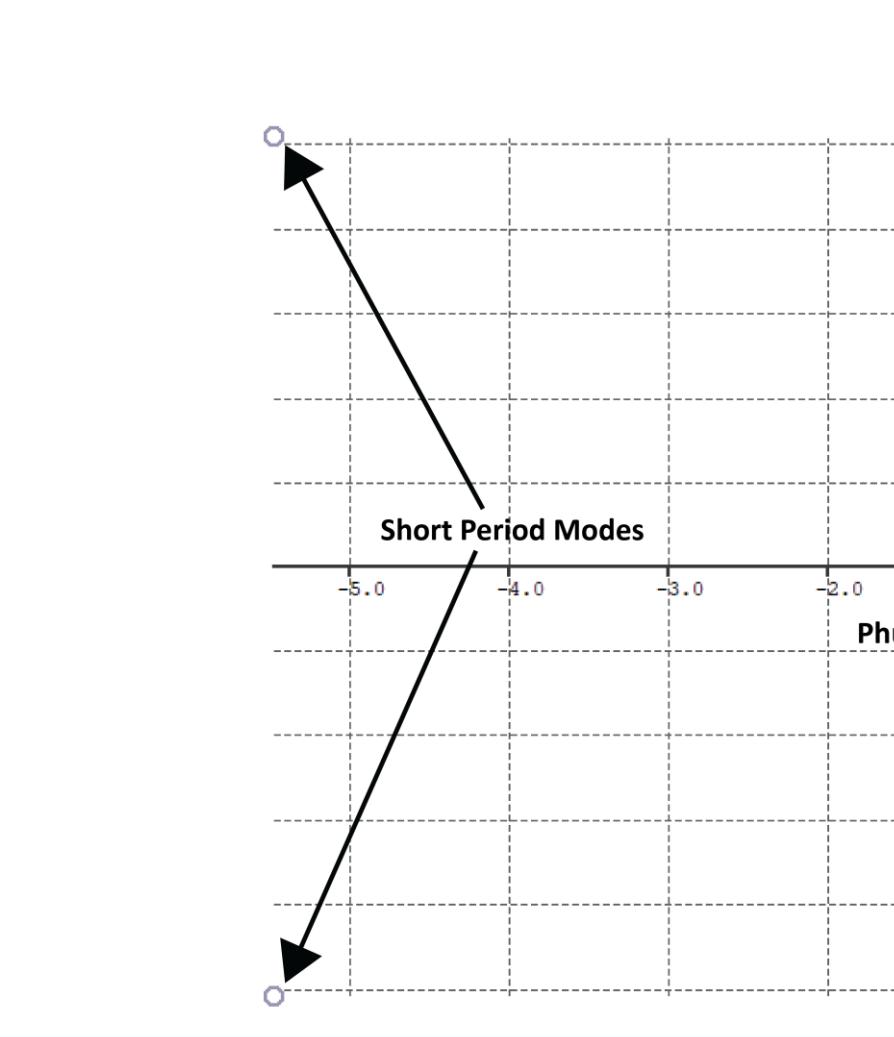
## Stability analysis



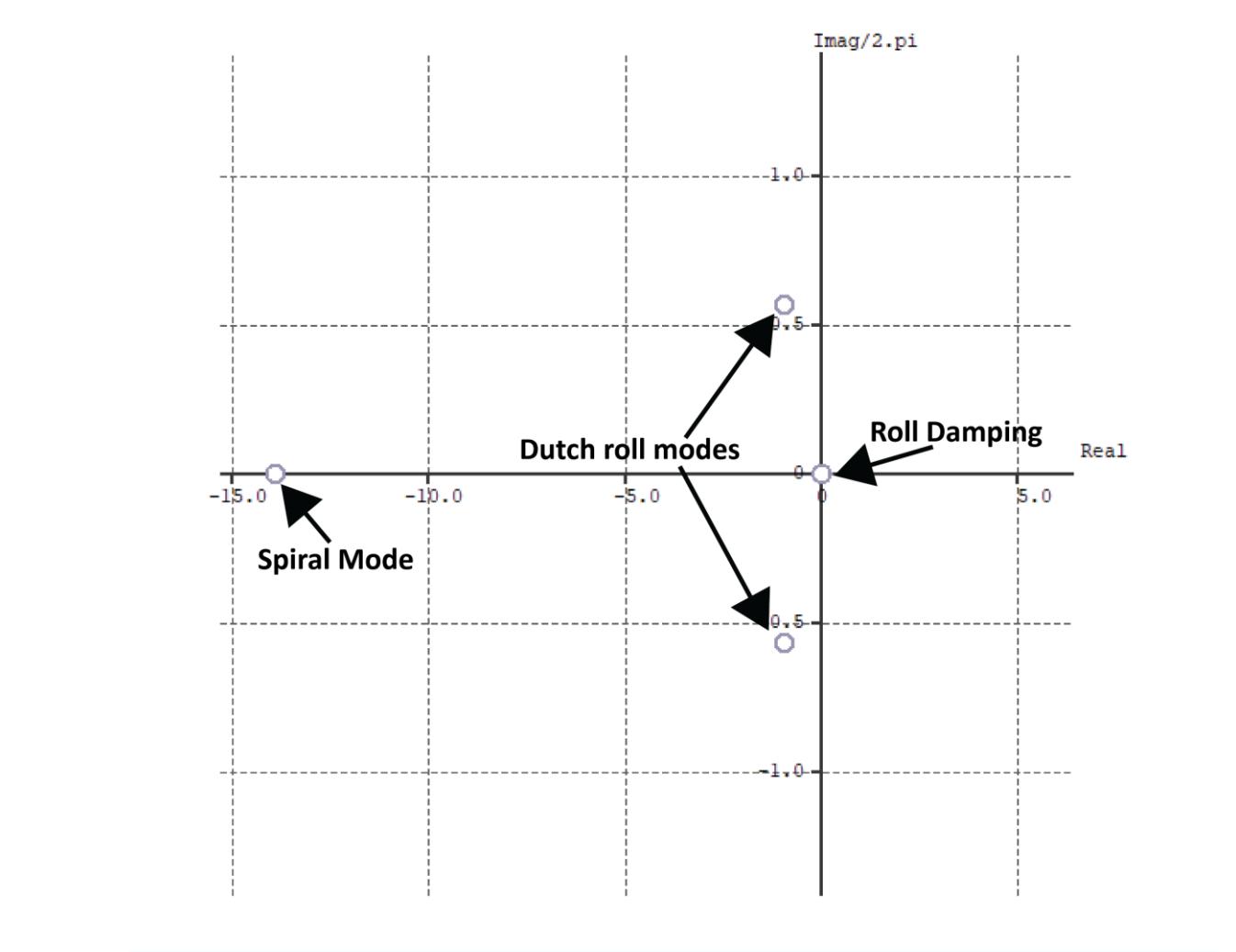
Longitudinal Static Stability



Lateral Static Stability



Longitudinal Dynamic Modes



Lateral Dynamic Modes

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## Dynamic Stability Test

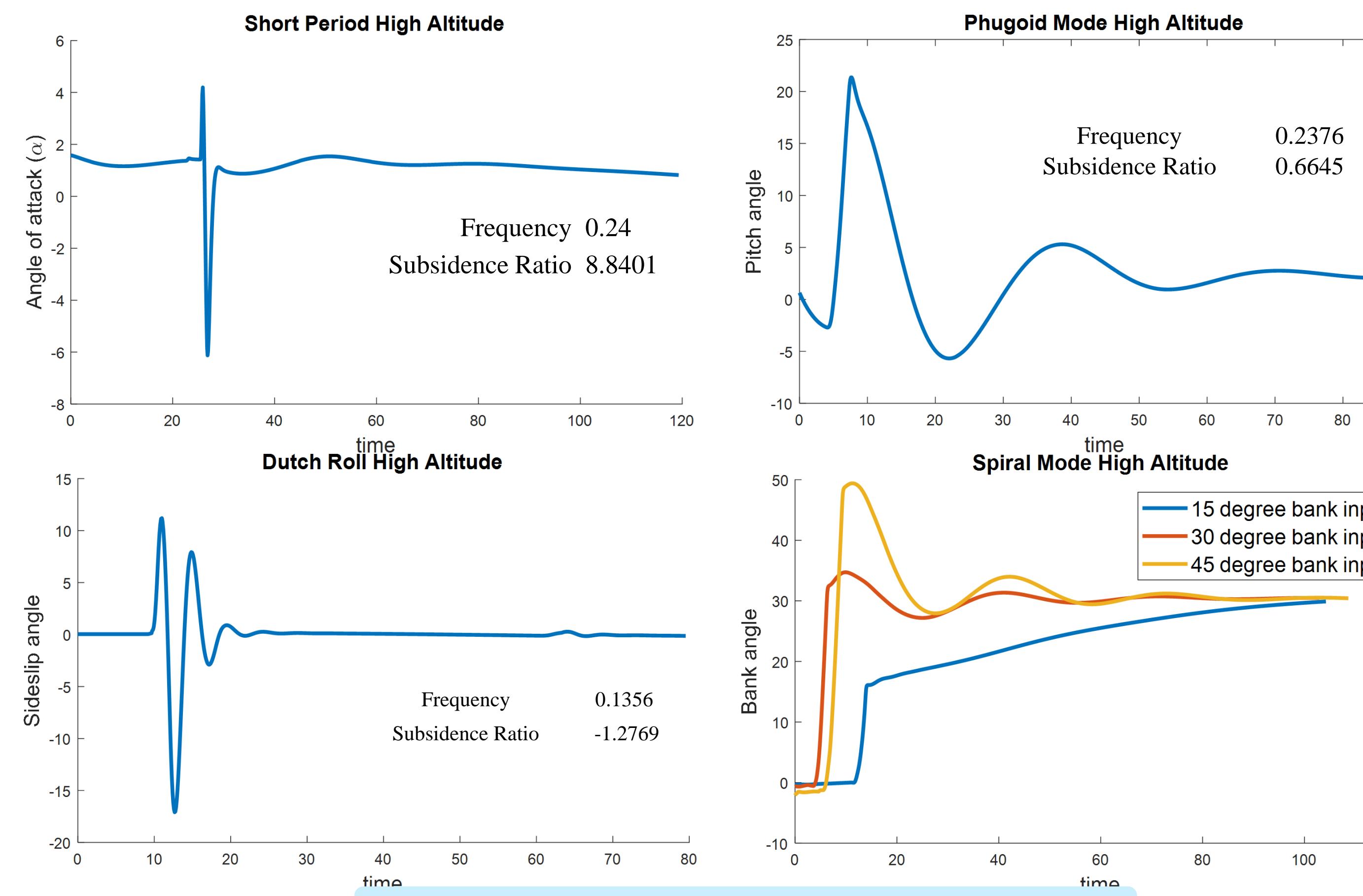


Figure : Dynamic Characteristics

## Stall Characteristics

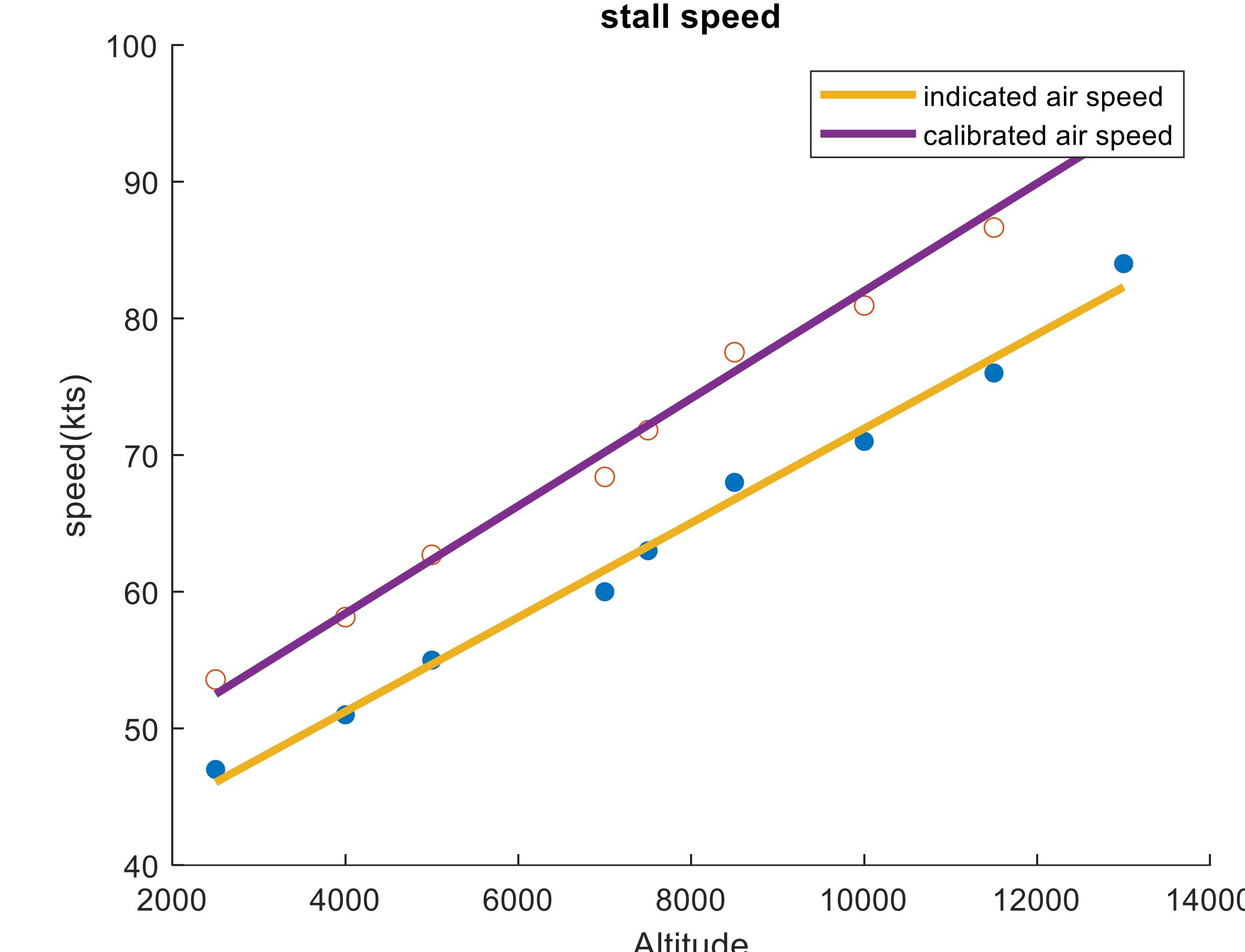


Figure: Altitude vs Stall speed

## Takeoff Characteristics

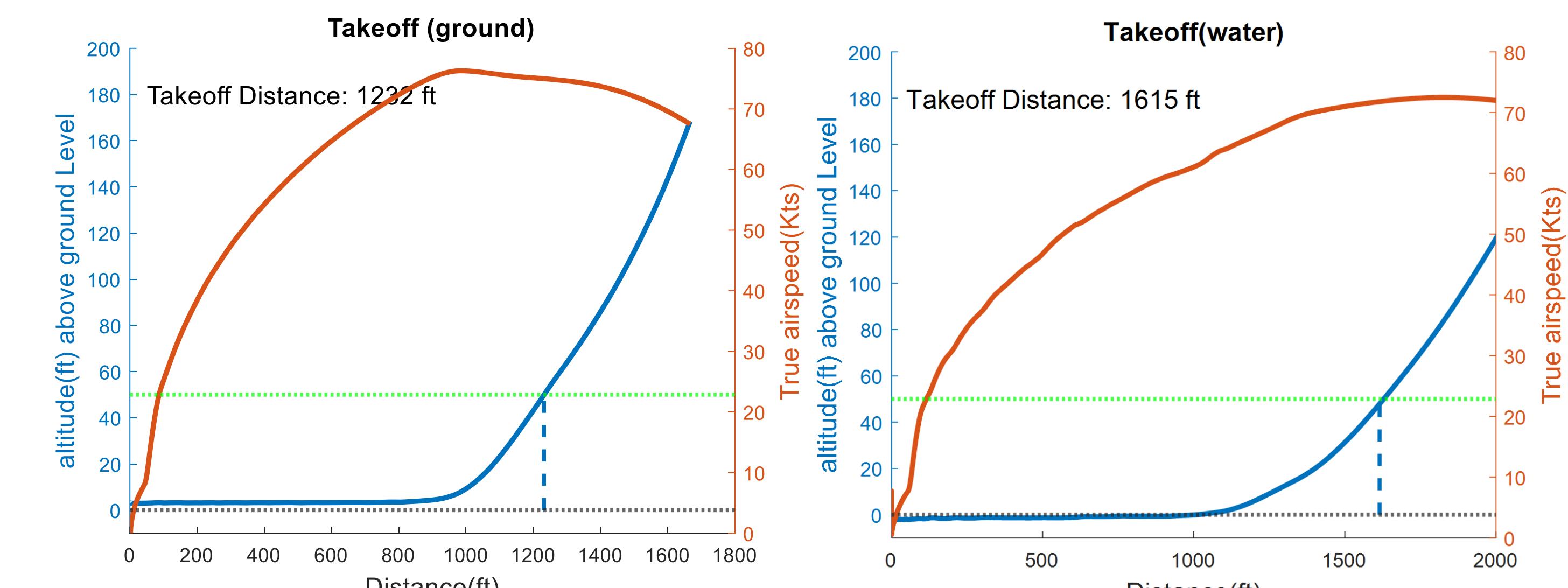


Figure: Takeoff Distance vs Alt (on ground )

Figure: Takeoff Distance vs Alt (on water )

## Landing Characteristics

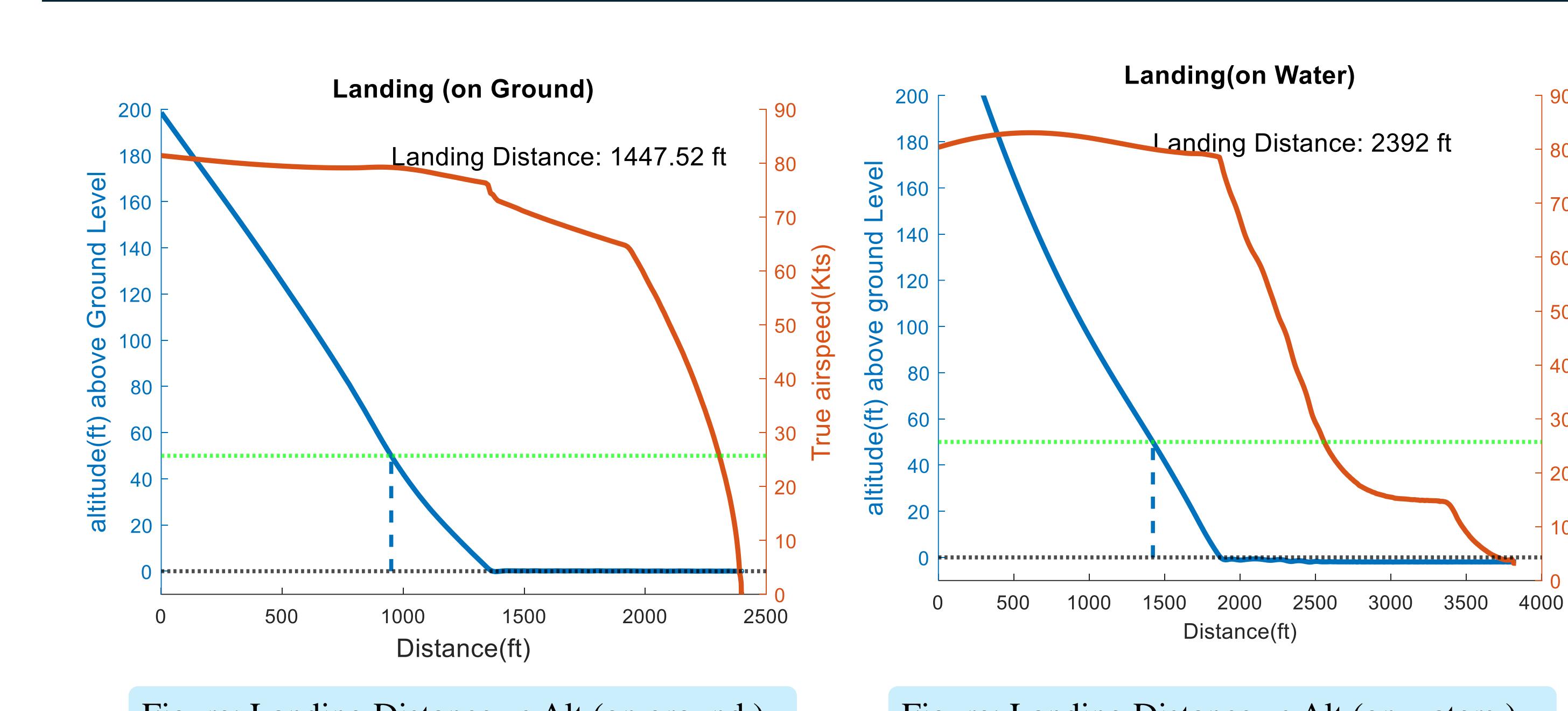


Figure: Landing Distance vs Alt (on ground )

Figure: Landing Distance vs Alt (on waters )

## Handling Quality Test

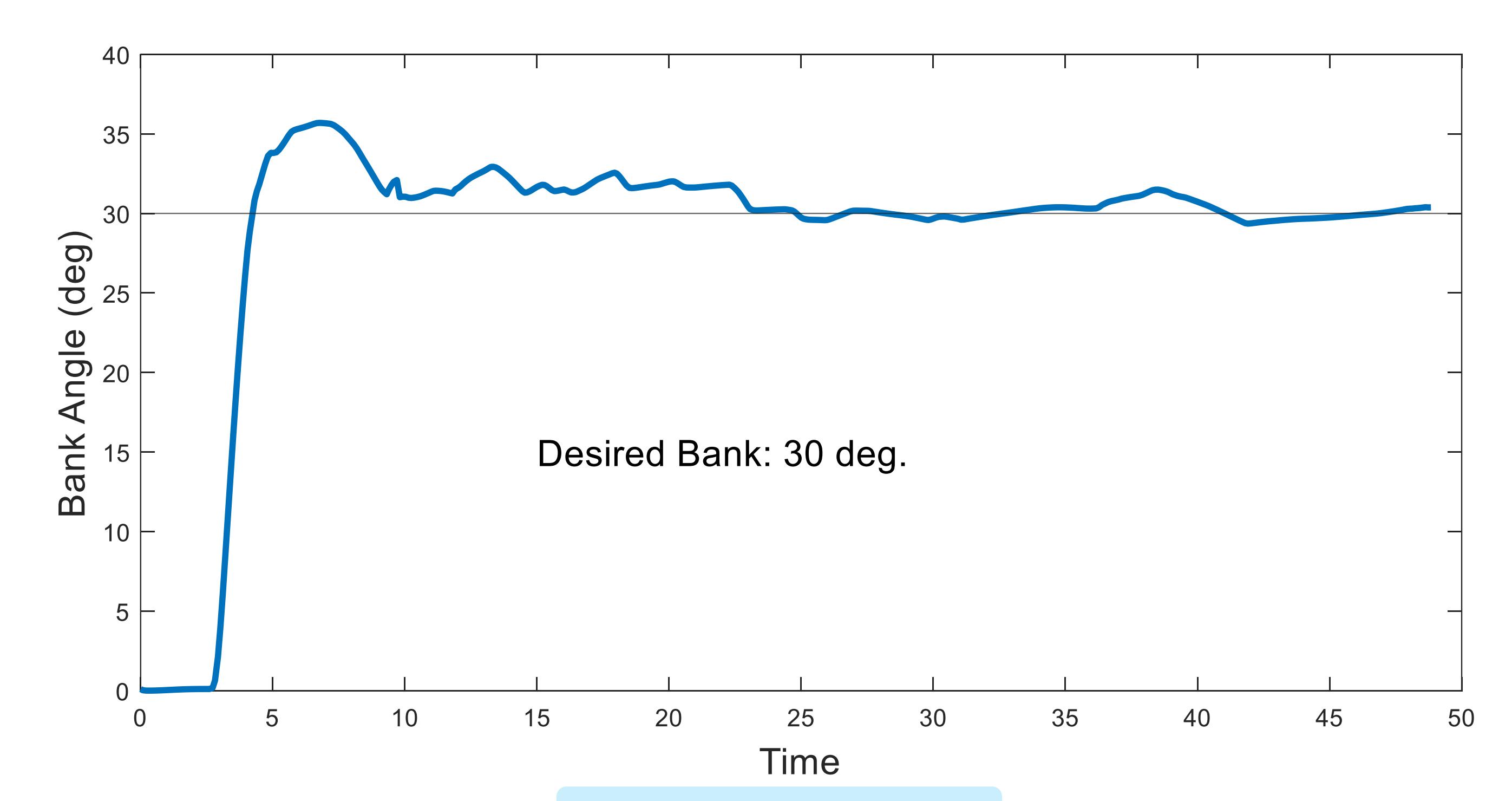


Figure : Bank Angle vs Time

The aircraft was rated '3' as per Cooper Harper Rating Scale. The aircraft had some mild unpleasant deficiencies and minimal pilot compensation was required for desired characteristics.

## Conclusion

**SPLOOSH** successfully completed the preliminary flight tests confirming its excellent performance in short takeoff and landing (STOL) operations on water as well as land. The aircraft demonstrated reliable handling, stability, and adaptability in varied conditions, making it ideal for remote and water-bound locations. SPLOOSH had range of 1200km and endurance of 5.2 hr making comfortable for commercial flight of 18 passengers in amphibious regions.

## Neutral Point Determination

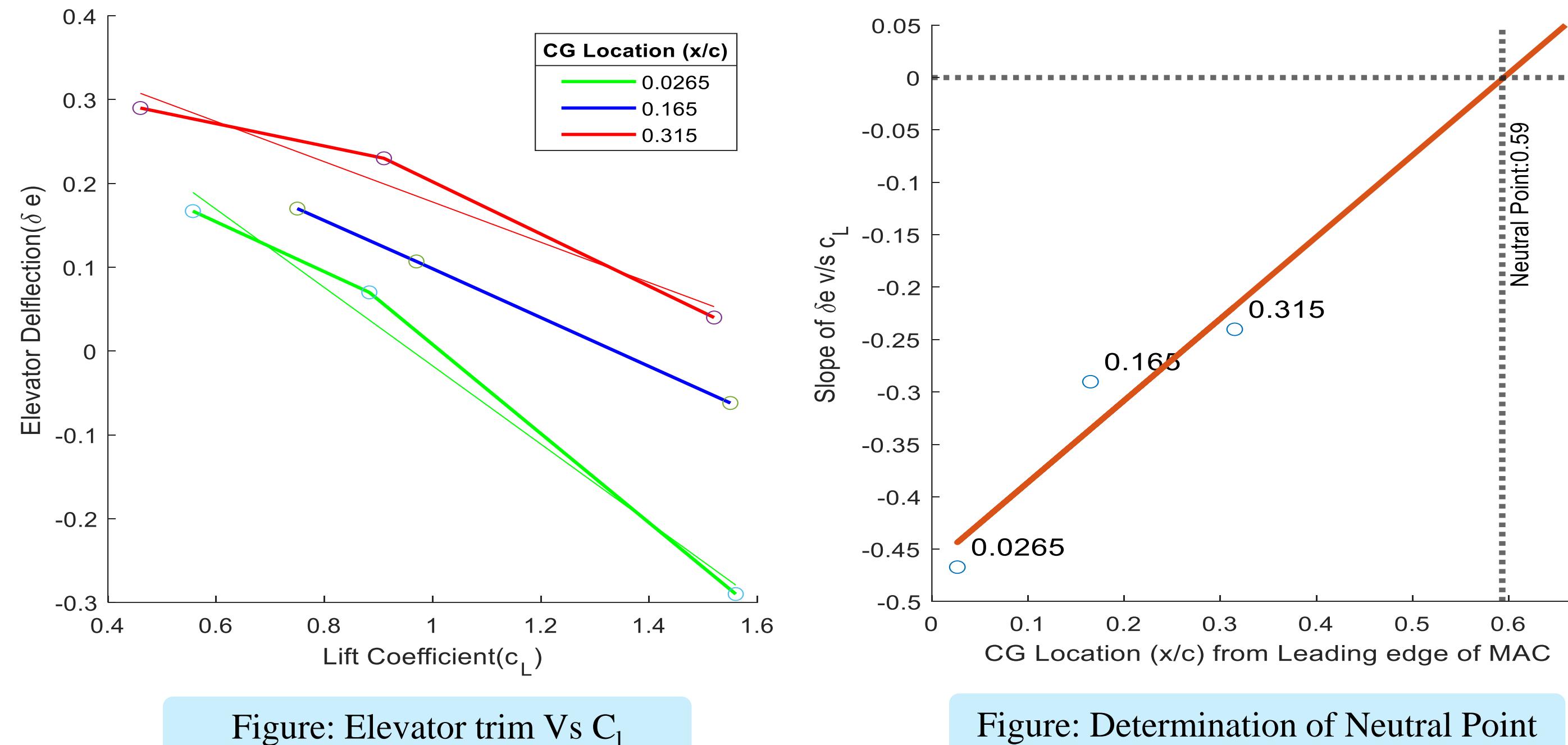


Figure: Elevator trim Vs  $C_L$

Figure: Determination of Neutral Point

## CG Travel Diagram

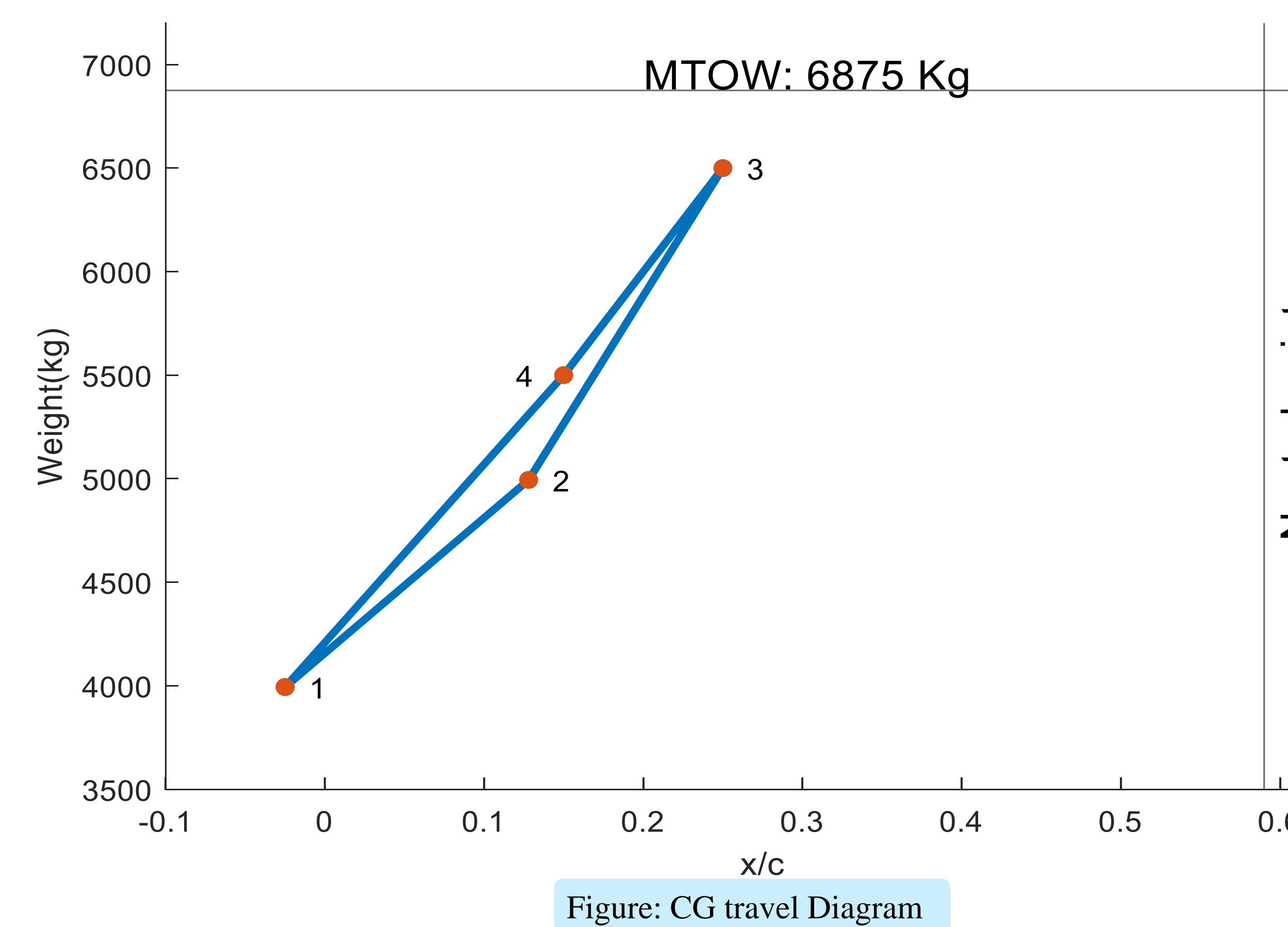


Figure: CG travel Diagram

## ROC vs True Airspeed

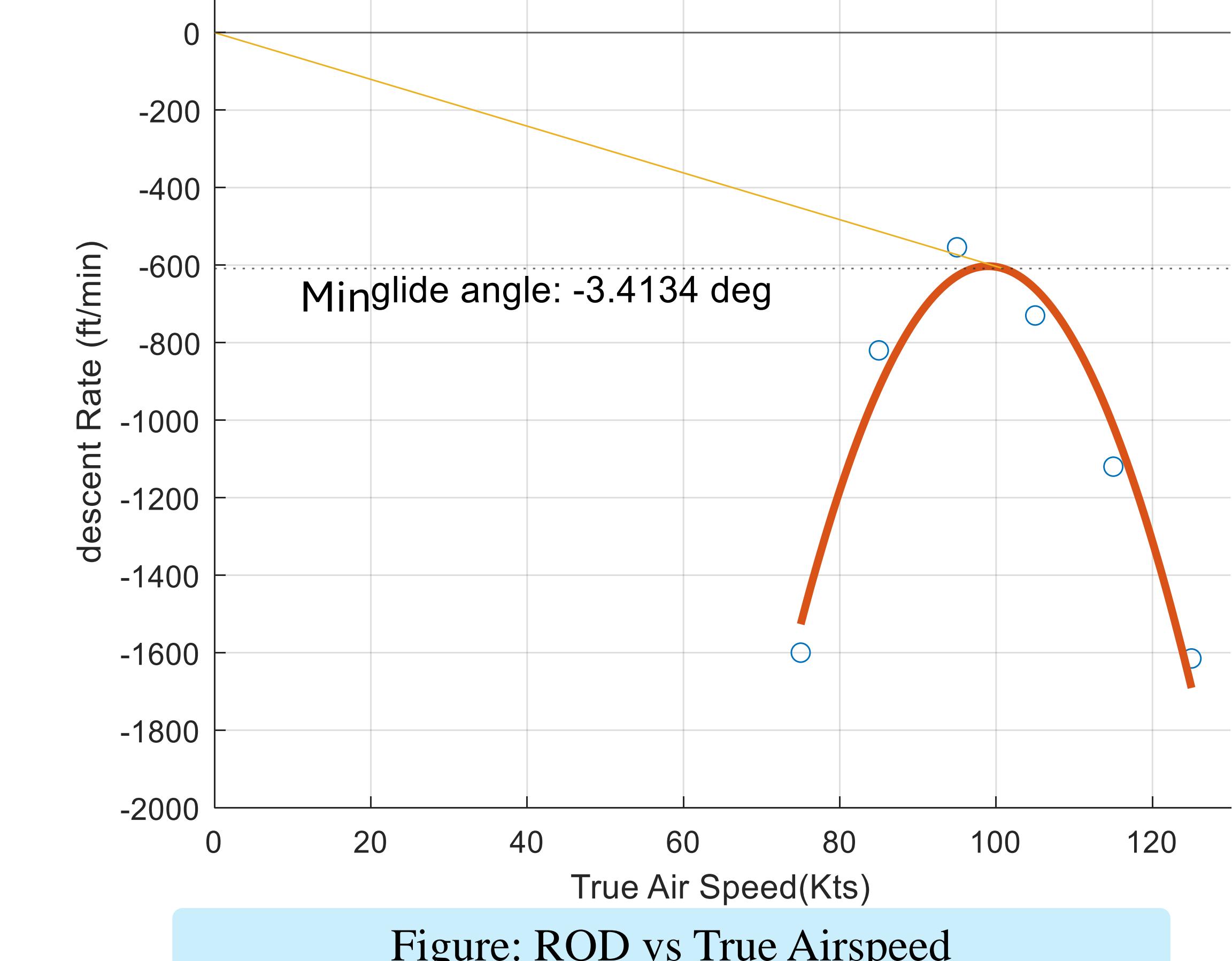


Figure: ROC vs True Airspeed

## ROD vs True Airspeed

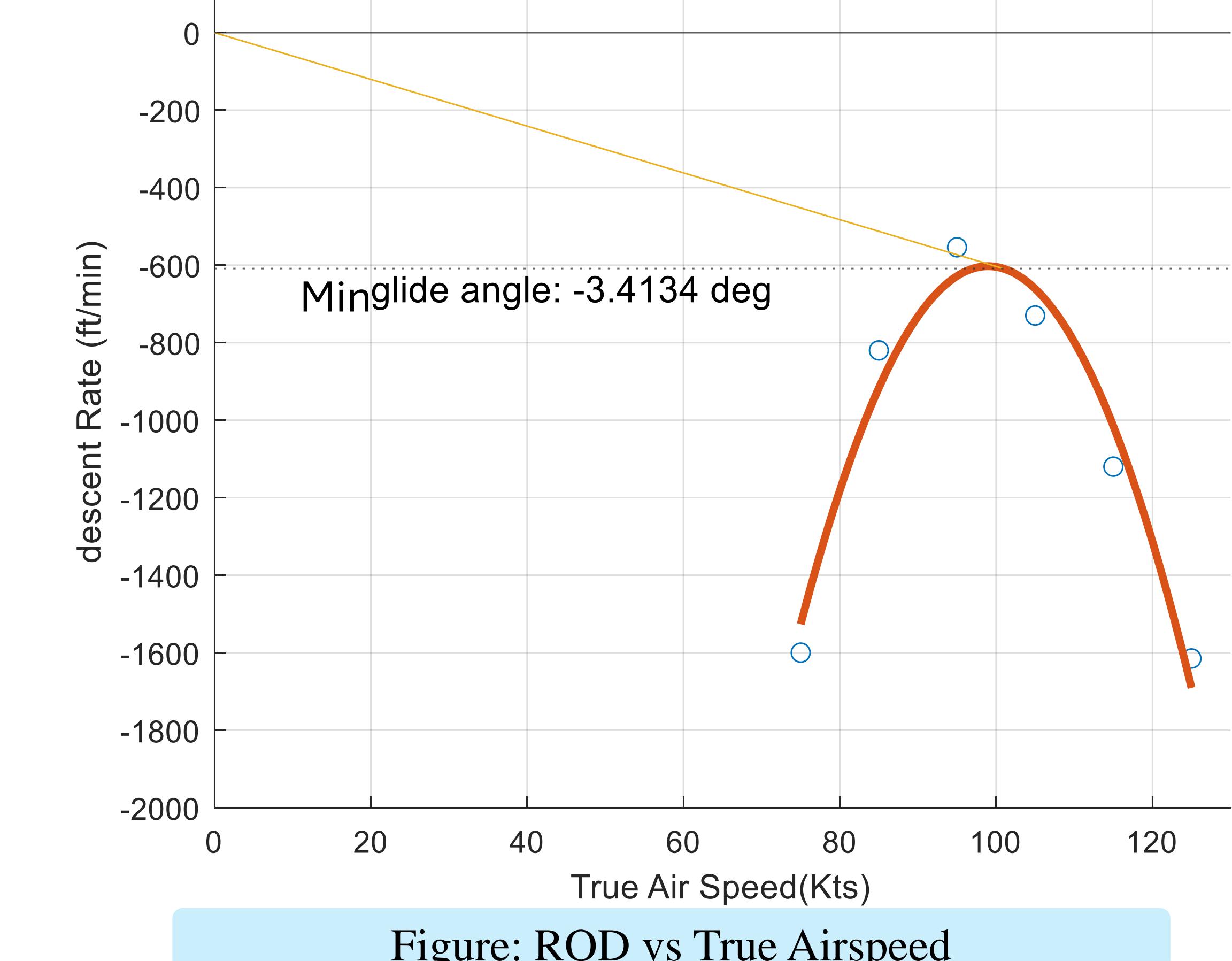


Figure: ROD vs True Airspeed