# A&L Engineering

**Supply Drop Plan**

# DIAGRAM

height

2650

meters

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| --- |
| V = 250mph (velocity of the plane) |
| Airplane with solid fill  2599.53 meters  Payload initial Velocity  0mph  Drop site |

# INITIAL CALCULATIONS

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| Provide your calculations, including all relevant steps are included and your units are labeled. |

∆Y =

∆Y = the planes height = 2650m

Initial velocity = 0 m/s

t = time = ?

earth’s gravitational pull (9.8 m/)

2650m = 0 + (9.8m/

=

=

t = 23.26s

D = ST

D = distance from drop site (horizontal motion)

S = planes velocity = 111.76m/s

T = time it took for payload impact to the ground = 23.26s

D = (111.76m/s)(23.26s)

D = 2599.54m (Horizontal motion)

## Description

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| Describe the components of the kinematics equations used in your initial calculations below. |

To find the horizontal motion I would have to find X. To make it easier on myself I labeled X as D for distance. The formula needed to find the Distance here would be D=ST (D being distance, S being the velocity, and T being the time it took to impact. From here I saw I still needed to solve for the T variable to go any further, so I used this formula ∆Y =. (∆Y being the planes height off the ground, being the initial velocity, t being the time it took to impact (what we are solving for) a being the acceleration due to gravity). Filling in the variables it looked like 2650m = 0 + (9.8m/. After solving for this I got the answer t = 23.26s. Next, I had to then plug that into the distance formula but saw an issue. My distance units need to be changed to m/s instead of mph. I did a quick conversion on my velocity no making it 111.76m/s. Now I plugged it all in so it looked like this D = (111.76m/s)(23.26s).

Thus, making the distance and horizontal motion 2599.54m.

# MODIFIED SCENARIO ONE

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| --- |
| Create a diagram showing the first modified scenario. Then adjust your initial calculations to incorporate the changing variables from the scenario and describe how these changed variables affect your calculations. |

## Diagram

Headwind = 7 mph

|  |  |
| --- | --- |
| |  | | --- | | Airplane with solid fill V = 250mph (velocity of the plane)  2526.73 meters  height  2650  meters  Drop site | |

## Description

The drop site in this case was in Daytona Beach, Florida on 5-18-22. The windspeed on this day was 7mph which caused a headwind that the plane had to fly against. In order to take the headwind into consideration the units have to be the same so the 7 mph(windspeed, national weather service, weather.gov) would now equal 3.13. The plane facing the new conditions will affect the velocity making it 108.63. With the new velocity means a new position on which we drop the payload. Multiplying the previous time and the new velocity gives us this new horizontal distance of 2526.73.

Seeing the new distance this added condition shows that for the payload to reach its destination it would have to be dropped later (shorter distance) than originally.

# MODIFIED SCENARIO TWO

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| --- |
| Create a diagram showing the second modified scenario. Then adjust your initial calculations to incorporate the changing variables from the scenario and describe how these changed variables affect your calculations. |

## Diagram

50

meters

400 meters

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| --- |
| Velocity = 67  50 |

## Description

In figuring out whether or not a catapult would work with the information given, I had to first figure out whether or not the catapult could fire high enough with firing angle being 50 and the velocity being 67 . To do this I used the formula y(being max height) = . I plugged in the variables with the number that were already provided ( 67 , =50, and g being gravity was 9.8) giving me the equation y = = . After solving this my max height came out to 134.40 meters which is greater than the height of the drop site. Now that I know that it can reach the required height, I had to solve for the distance of the drop site. The distance formula I used was x = ()t. This couldn’t be solved until I knew the t(time) it took so the formula then used was t = . This equation looked like t = . Solving the equation gave me t = 10.74s. Now t can be used in the other formula giving me x = ()( 10.74s). Leaving x = 462.53 meters as the range and the range being longer than the distance to the drop site. With the x and y values being greater than the information provided I could conclude that the catapult at 400m away, angled at 50, and firing at a velocity of would be sufficient to getting the supplies to the drop site.

**Citations**

National Weather Service(Daytona Beach), May 18, 2022[Weather report]. Retrieved from https://forecast.weather.gov/MapClick.php?x=175&y=30&site=mlb&zmx=&zmy=&map\_x=174&map\_y=30#.YoqysXbMK3A