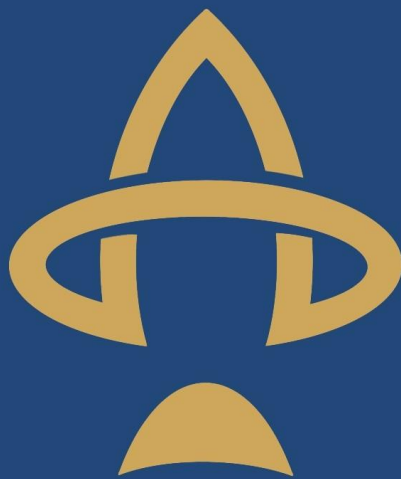




# Rocket Mission Works



Fuel Planning Guide  
*Version 1.0 - Oct 2023*

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# 1. Overview

This reference guide provides instruction for application of the “Bingo Calculator” and the “Mission Fuel Calculator”. The “Bingo Calculator” enables calculation of a Bingo fuel level, that is the minimum amount of remaining fuel to return to base from the target area, and Joker fuel level, that is the standard amount of remaining fuel when egress from the target area should occur. The “Mission Fuel Calculator” enables calculation of fuel required for the entire mission.

Appendix 1 provides a “Quick Bingo Range Guide”, a quick reference for Bingo fuel levels for visual flight rules at various ranges and altitudes.

Appendix 2 provides the data used to calculate fuel consumption.

This reference guide should be used for planning purposes when mission building or strike planning.

*Note: The calculations in this guide assume optimal flying performance and conditions.*

## 2. Background

A crucial part of the mission planning process is determining how much fuel will be required to complete the mission. Each airframes fuel burn rate differs based on speed, altitude, and loadout. Real mission planners have tools designed specifically to make these calculations. For DCS, general fuel burn rate estimations can give a starting point to estimate fuel requirements to complete a mission.

Minimizing fuel loaded on the aircraft can improve performance when conducting combat operations by reducing overall aircraft weight. Calculating fuel requirements for return flights is also vital to ensure pilots know the point they must leave the target area to safely return home, or will require airborne tanker support.



### 3. Methodology

Aircraft fuel burn rates were recorded during ideal weather conditions on aircraft with no external stores. Fuel burn rates for each aircraft were recorded while flying at the following altitudes and speeds.

| Altitude | Speed       |
|----------|-------------|
| 10 kft   | 420 kts TAS |
| 20 kft   | .8 Mach     |
| 30 kft   | .8 Mach     |

For aircraft with fuel flow displays an instantaneous reading was taken when the aircraft was at a stable speed. For aircraft without fuel flow displays the aircraft was brought to a stable speed and Active Pause was activated. Time was accelerated until one hour has passed and the fuel state difference was noted.

*Note: The A-10C was tested at a consistent 300 kts TAS. The SU-25T Mach indicator is currently bugged, resulting in slower speeds.*

# 4. Bingo & Joker Fuel Calculator

## Overview

The calculation of Bingo & Joker fuel levels considers multiple factors; fuel for taxing, landing conditions, distance to alternate airfield, and distance and altitude for flight from the target area to the primary airfield.

|                                      |         |                |                |
|--------------------------------------|---------|----------------|----------------|
| Aircraft                             | AV-8B ▼ |                |                |
| Fuel for Taxing                      | 800 lb  |                |                |
| Fuel for Go-Around                   |         |                |                |
| Flight Regime                        |         |                |                |
| VFR ▼                                | 400 lb  |                |                |
| Fuel for Go-To Alternate             |         |                |                |
| Distance from Homeplate to Alternate | 75      | Distance in NM |                |
| Fuel for Egress                      |         |                |                |
| Route from Target to Homeplate       |         |                | Fuel Flow Rate |
| High Altitude (30k) ▼                | 250     | Distance in NM | 7 lb/NM        |
| <b>Bingo</b> 3700 lb                 |         |                |                |
| Fuel Buffer                          | 1000 lb |                |                |
| <b>Joker</b> 4700 lb                 |         |                |                |

# 4. Bingo & Joker Fuel Calculator

## Instructions

|  |                                  |                               |
|--|----------------------------------|-------------------------------|
| Aircraft                                   | <div>AV-8B ▼</div>               | Select Aircraft               |
| Fuel for Taxing                            | 800 lb                           |                               |
| Fuel for Go-Around                         |                                  |                               |
| Flight Regime                              | <div>VFR ▼</div>                 | 400 lb                        |
|  |                                  | Select Landing Conditions     |
| Fuel for Go-To Alternate                   |                                  |                               |
| Distance from Homeplate to Alternate       | <div>75</div>                    | Distance in NM                |
| Fuel for Egress                            |                                  |                               |
| Route from Target to Homeplate             | <div>High Altitude (30k) ▼</div> | <div>250</div> Distance in NM |
|  |                                  | Fuel Flow Rate<br>7 lb/NM     |
| Select Transit Altitude and Enter Altitude |                                  |                               |
| <div>Bingo</div>                           | <div>3700 lb</div>               |                               |
| Fuel Buffer                                | 1000 lb                          |                               |
| <div>Joker</div>                           | <div>4700 lb</div>               |                               |

Adjusting the four sections results in automatic calculation of Bingo and Joker fuel levels. Units of weight will adjust based on the aircraft selected.

# 5. Mission Fuel Calculator

## Overview

The calculation of Minimum Mission Fuel is based off the previous Joker calculation with the addition of fuel requirements for taxi and departure, transit to the target area, and fulfillment of the planned vul time. The transit and vul fuel requirements are multiplied by a factor of 1.5 to account for additional drag from munitions. Additional Margin can be added as desired to calculate Required Mission Fuel.

|                                       |                                  |                            |                             |
|---------------------------------------|----------------------------------|----------------------------|-----------------------------|
| Aircraft                              | AV-8B                            |                            |                             |
| Joker Fuel                            | 4700 lb                          |                            |                             |
| Aerial Refueling?                     | Yes ▼                            |                            |                             |
| Fuel for Taxing & Departure           | 1600 lb                          |                            |                             |
| Fuel to Target Area                   |                                  |                            |                             |
| Route to Target from Homeplate/Tanker | <div>High Altitude (30k) ▼</div> | <div></div> Distance in NM | Fuel Flow Rate<br>7 lb/NM   |
| Fuel for Vul Time                     |                                  |                            |                             |
| Vul time                              | <div>High Altitude (30k) ▼</div> | <div></div> Mins           | Fuel Flow Rate<br>54 lb/min |
| <b>Minimum Mission Fuel</b>           |                                  | <b>8000 lb</b>             |                             |
| Additional Margin                     | <div></div>                      | lb                         |                             |
| <b>Required Mission Fuel</b>          |                                  | <b>8000 kg</b>             |                             |



# 5. Mission Fuel Calculator

## Instructions

|  |                                  |                     |                |
|--|----------------------------------|---------------------|----------------|
| Aircraft                                   | AV-8B                            |                     |                |
| Joker Fuel                                 | 4700 lb                          |                     |                |
| Aerial Refueling?                          | <div>Yes ▾</div>                 |                     |                |
| Fuel for Taxing & Departure                | 1600 lb                          |                     |                |
| Fuel to Target Area                        |                                  |                     |                |
| Route to Target from Homeplate/Tanker      | <div>High Altitude (30k) ▾</div> | <div></div>         | Fuel Flow Rate |
|  |                                  | Distance in NM      | 7 lb/NM        |
| Select Transit Altitude and Enter Distance |                                  |                     |                |
| Fuel for Vul Time                          |                                  |                     |                |
| Vul time                                   | <div>Enter Vul Time</div>        | <div></div> Mins    | Fuel Flow Rate |
|  | <div>High Altitude (30k) ▾</div> | Select Vul Altitude | 54 lb/min      |
| Minimum Mission Fuel                       |                                  | 8000 lb             |                |
| Additional Margin                          | <div></div> lb                   | Enter Margin        |                |
| Required Mission Fuel                      |                                  | 8000 kg             |                |

Adjusting the first two sections results in automatic calculation of the Minimum Mission Fuel. Selecting Aerial Refueling will remove Taxi and Departure fueling requirements. Adding additional Fuel Margin to compensate for airmanship and environmental variability results in the Required Mission Fuel. Units of weight will adjust based on the aircraft selected.

# Appendix 1: Quick Bingo Range Guide

## Blue Aircraft

| Fuel in lb |        | Range (NM) |      |      |      |      |      |      |      |
|------------|--------|------------|------|------|------|------|------|------|------|
|            |        | 50         | 100  | 150  | 200  | 250  | 300  | 350  | 400  |
| A-10C      | 10 kft | 1800       | 2300 | 2800 | 3400 | 3900 | 4400 | 5000 | 5500 |
|            | 20 kft | 1700       | 2100 | 2600 | 3000 | 3500 | 3900 | 4400 | 4800 |
|            | 30 kft | 1700       | 2100 | 2500 | 3000 | 3400 | 3800 | 4300 | 4700 |
| AV-8B      | 10 kft | 1900       | 2500 | 3100 | 3700 | 4300 | 4900 | 5500 | 6100 |
|            | 20 kft | 1700       | 2100 | 2600 | 3000 | 3500 | 3900 | 4400 | 4800 |
|            | 30 kft | 1600       | 1900 | 2300 | 2600 | 3000 | 3300 | 3600 | 4000 |
| F-14B      | 10 kft | 2000       | 2700 | 3500 | 4200 | 4900 | 5700 | 6400 | 7200 |
|            | 20 kft | 1900       | 2500 | 3200 | 3800 | 4500 | 5100 | 5800 | 6400 |
|            | 30 kft | 1800       | 2300 | 2900 | 3400 | 4000 | 4500 | 5100 | 5600 |
| F-15C      | 10 kft | 2300       | 3300 | 4300 | 5300 | 6400 | 7400 | 8400 | 9400 |
|            | 20 kft | 2100       | 3000 | 3900 | 4700 | 5600 | 6500 | 7300 | 8200 |
|            | 30 kft | 1900       | 2600 | 3200 | 3900 | 4600 | 5200 | 5900 | 6600 |
| F-15E      | 10 kft | 2200       | 3200 | 4100 | 5100 | 6000 | 7000 | 7900 | 8900 |
|            | 20 kft | 2100       | 2900 | 3800 | 4600 | 5500 | 6300 | 7200 | 8000 |
|            | 30 kft | 1900       | 2500 | 3100 | 3800 | 4400 | 5000 | 5700 | 6300 |
| F-16       | 10 kft | 1700       | 2200 | 2600 | 3100 | 3500 | 4000 | 4400 | 4900 |
|            | 20 kft | 1600       | 2000 | 2400 | 2800 | 3200 | 3600 | 3900 | 4300 |
|            | 30 kft | 1600       | 1900 | 2300 | 2600 | 2900 | 3300 | 3600 | 3900 |
| F-18       | 10 kft | 2200       | 3100 | 4000 | 4900 | 5800 | 6700 | 7600 | 8500 |
|            | 20 kft | 1600       | 2000 | 2400 | 2800 | 3200 | 3600 | 3900 | 4300 |
|            | 30 kft | 1800       | 2400 | 3000 | 3500 | 4100 | 4700 | 5200 | 5800 |
| F-5        | 10 kft | 1700       | 2100 | 2500 | 3000 | 3400 | 3800 | 4200 | 4700 |
|            | 20 kft | 1500       | 1800 | 2100 | 2400 | 2700 | 2900 | 3200 | 3500 |
|            | 30 kft | 1500       | 1700 | 1900 | 2100 | 2300 | 2500 | 2700 | 2900 |
| Fuel in kg |        |            |      |      |      |      |      |      |      |
| M-2000C    | 10 kft | 900        | 1200 | 1500 | 1800 | 2000 | 2300 | 2600 | 2900 |
|            | 20 kft | 800        | 1000 | 1200 | 1400 | 1600 | 1800 | 2000 | 2200 |
|            | 30 kft | 800        | 900  | 1100 | 1200 | 1400 | 1500 | 1700 | 1800 |

# Appendix 1: Quick Bingo Range Guide

## Red Aircraft

| Fuel in kg |        | Range (NM) |      |      |      |      |      |      |      |
|------------|--------|------------|------|------|------|------|------|------|------|
|            |        | 50         | 100  | 150  | 200  | 250  | 300  | 350  | 400  |
| MIG-21     | 10 kft | 900        | 1200 | 1400 | 1700 | 1900 | 2200 | 2400 | 2700 |
|            | 20 kft | 900        | 1100 | 1300 | 1600 | 1800 | 2000 | 2200 | 2500 |
|            | 30 kft | 900        | 1100 | 1300 | 1500 | 1700 | 1900 | 2100 | 2300 |
| MIG-29S    | 10 kft | 900        | 1200 | 1500 | 1800 | 2100 | 2400 | 2700 | 3000 |
|            | 20 kft | 900        | 1200 | 1400 | 1700 | 1900 | 2200 | 2400 | 2700 |
|            | 30 kft | 800        | 1000 | 1200 | 1300 | 1500 | 1700 | 1800 | 2000 |
| SU-25T     | 10 kft | 1200       | 1800 | 2400 | 3000 | 3600 | 4200 | 4800 | 5400 |
|            | 20 kft | 1300       | 2000 | 2700 | 3400 | 4100 | 4800 | 5500 | 6200 |
|            | 30 kft | 1300       | 2000 | 2700 | 3400 | 4100 | 4800 | 5500 | 6200 |
| SU-27      | 10 kft | 1000       | 1400 | 1800 | 2200 | 2600 | 3000 | 3400 | 3800 |
|            | 20 kft | 1000       | 1300 | 1700 | 2000 | 2300 | 2700 | 3000 | 3400 |
|            | 30 kft | 900        | 1200 | 1500 | 1700 | 2000 | 2300 | 2500 | 2800 |
| SU-33      | 10 kft | 1100       | 1500 | 1900 | 2300 | 2800 | 3200 | 3600 | 4000 |
|            | 20 kft | 1000       | 1400 | 1800 | 2200 | 2500 | 2900 | 3300 | 3700 |
|            | 30 kft | 900        | 1200 | 1500 | 1800 | 2100 | 2400 | 2700 | 3000 |
| J-11       | 10 kft | 1100       | 1500 | 1900 | 2400 | 2800 | 3200 | 3600 | 4100 |
|            | 20 kft | 1000       | 1400 | 1700 | 2100 | 2400 | 2800 | 3200 | 3500 |
|            | 30 kft | 900        | 1200 | 1500 | 1800 | 2100 | 2400 | 2600 | 2900 |
| JF-17      | 10 kft | 900        | 1200 | 1500 | 1800 | 2100 | 2400 | 2700 | 3000 |
|            | 20 kft | 900        | 1200 | 1500 | 1800 | 2100 | 2400 | 2700 | 3000 |
|            | 30 kft | 900        | 1100 | 1300 | 1600 | 1800 | 2000 | 2300 | 2500 |

# Appendix 2: Fuel Flow Rate Tables

## Blue Aircraft

| A-10C |                   |             |        |         |
|-------|-------------------|-------------|--------|---------|
|       | Fuel Rate (lb/hr) | TAS (NM/hr) | lbs/NM | lbs/min |
| 10kft | 3200              | 300         | 11     | 53      |
| 20kft | 2700              | 300         | 9      | 45      |
| 30kft | 2600              | 300         | 9      | 43      |

| AV-8B |                    |             |        |    |
|-------|--------------------|-------------|--------|----|
|       | Fuel Rate (lb/min) | TAS (NM/hr) | lbs/NM |    |
| 10kft | 85                 | 420         | 12     | 85 |
| 20kft | 74                 | 495         | 9      | 74 |
| 30kft | 54                 | 475         | 7      | 54 |

| F-14B |                   |             |        |         |
|-------|-------------------|-------------|--------|---------|
|       | Fuel Rate (lb/hr) | TAS (NM/hr) | lbs/NM | lbs/min |
| 10kft | 6200              | 420         | 15     | 103     |
| 20kft | 6400              | 495         | 13     | 107     |
| 30kft | 5200              | 475         | 11     | 87      |

| F-15C |                   |             |        |         |
|-------|-------------------|-------------|--------|---------|
|       | Fuel Rate (lb/hr) | TAS (NM/hr) | lbs/NM | lbs/min |
| 10kft | 8600              | 420         | 20     | 143     |
| 20kft | 8600              | 495         | 17     | 143     |
| 30kft | 6300              | 475         | 13     | 105     |

| F-15SE |                   |             |        |         |
|--------|-------------------|-------------|--------|---------|
|        | Fuel Rate (lb/hr) | TAS (NM/hr) | lbs/NM | lbs/min |
| 10kft  | 8000              | 420         | 19     | 133     |
| 20kft  | 8400              | 495         | 17     | 140     |
| 30kft  | 6000              | 475         | 13     | 100     |

| F-16  |                   |             |        |         |
|-------|-------------------|-------------|--------|---------|
|       | Fuel Rate (lb/hr) | TAS (NM/hr) | lbs/NM | lbs/min |
| 10kft | 3800              | 420         | 9      | 63      |
| 20kft | 3800              | 495         | 8      | 63      |
| 30kft | 3200              | 475         | 7      | 53      |



# Appendix 2: Fuel Flow Rate Tables

## Blue Aircraft

| F-18  |                   |             |        |         |
|-------|-------------------|-------------|--------|---------|
|       | Fuel Rate (lb/hr) | TAS (NM/hr) | lbs/NM | lbs/min |
| 10kft | 7600              | 420         | 18     | 127     |
| 20kft | 7400              | 495         | 15     | 123     |
| 30kft | 5400              | 476         | 11     | 90      |

| F-5   |                   |             |        |         |
|-------|-------------------|-------------|--------|---------|
|       | Fuel Rate (lb/hr) | TAS (NM/hr) | lbs/NM | lbs/min |
| 10kft | 3600              | 420         | 9      | 60      |
| 20kft | 2800              | 495         | 6      | 47      |
| 30kft | 2000              | 476         | 4      | 33      |

| M-2000C |                    |             |       |    |
|---------|--------------------|-------------|-------|----|
|         | Fuel Rate (kg/min) | TAS (NM/hr) | kg/NM |    |
| 10kft   | 39                 | 420         | 6     | 39 |
| 20kft   | 33                 | 495         | 4     | 33 |
| 30kft   | 23                 | 476         | 3     | 23 |

# Appendix 2: Fuel Flow Rate Tables

## Red Aircraft

| MIG-21 |                   |             |       |         |
|--------|-------------------|-------------|-------|---------|
|        | Fuel Rate (kg/hr) | TAS (NM/hr) | kg/NM | kgs/min |
| 10kft  | 2125              | 420         | 5     | 35      |
| 20kft  | 2250              | 496         | 5     | 38      |
| 30kft  | 1925              | 476         | 4     | 32      |

| MIG-29S |                   |             |       |         |
|---------|-------------------|-------------|-------|---------|
|         | Fuel Rate (kg/hr) | TAS (NM/hr) | kg/NM | kgs/min |
| 10kft   | 2475              | 420         | 6     | 41      |
| 20kft   | 2550              | 496         | 5     | 43      |
| 30kft   | 1600              | 476         | 3     | 27      |

| SU-25T |                   |             |       |         |
|--------|-------------------|-------------|-------|---------|
|        | Fuel Rate (kg/hr) | TAS (NM/hr) | kg/NM | kgs/min |
| 10kft  | 5600              | 420         | 13    | 93      |
| 20kft  | 6600              | 496         | 13    | 110     |
| 30kft  | 5600              | 476         | 12    | 93      |

| SU-27 |                   |             |       |         |
|-------|-------------------|-------------|-------|---------|
|       | Fuel Rate (kg/hr) | TAS (NM/hr) | kg/NM | kgs/min |
| 10kft | 3300              | 420         | 8     | 55      |
| 20kft | 3350              | 496         | 7     | 56      |
| 30kft | 2550              | 476         | 5     | 43      |

| SU-33 |                   |             |       |         |
|-------|-------------------|-------------|-------|---------|
|       | Fuel Rate (kg/hr) | TAS (NM/hr) | kg/NM | kgs/min |
| 10kft | 3550              | 420         | 8     | 59      |
| 20kft | 3750              | 496         | 8     | 63      |
| 30kft | 2750              | 476         | 6     | 46      |

| J-11  |                   |             |       |         |
|-------|-------------------|-------------|-------|---------|
|       | Fuel Rate (kg/hr) | TAS (NM/hr) | kg/NM | kgs/min |
| 10kft | 3600              | 420         | 9     | 60      |
| 20kft | 3550              | 496         | 7     | 59      |
| 30kft | 2700              | 476         | 6     | 45      |

# Appendix 2: Fuel Flow Rate Tables

## Red Aircraft

| JF-17 |                   |             |       |         |
|-------|-------------------|-------------|-------|---------|
|       | Fuel Rate (kg/hr) | TAS (NM/hr) | kg/NM | kgs/min |
| 10kft | 2433              | 420         | 6     | 41      |
| 20kft | 2953              | 495         | 6     | 49      |
| 30kft | 2180              | 475         | 5     | 36      |