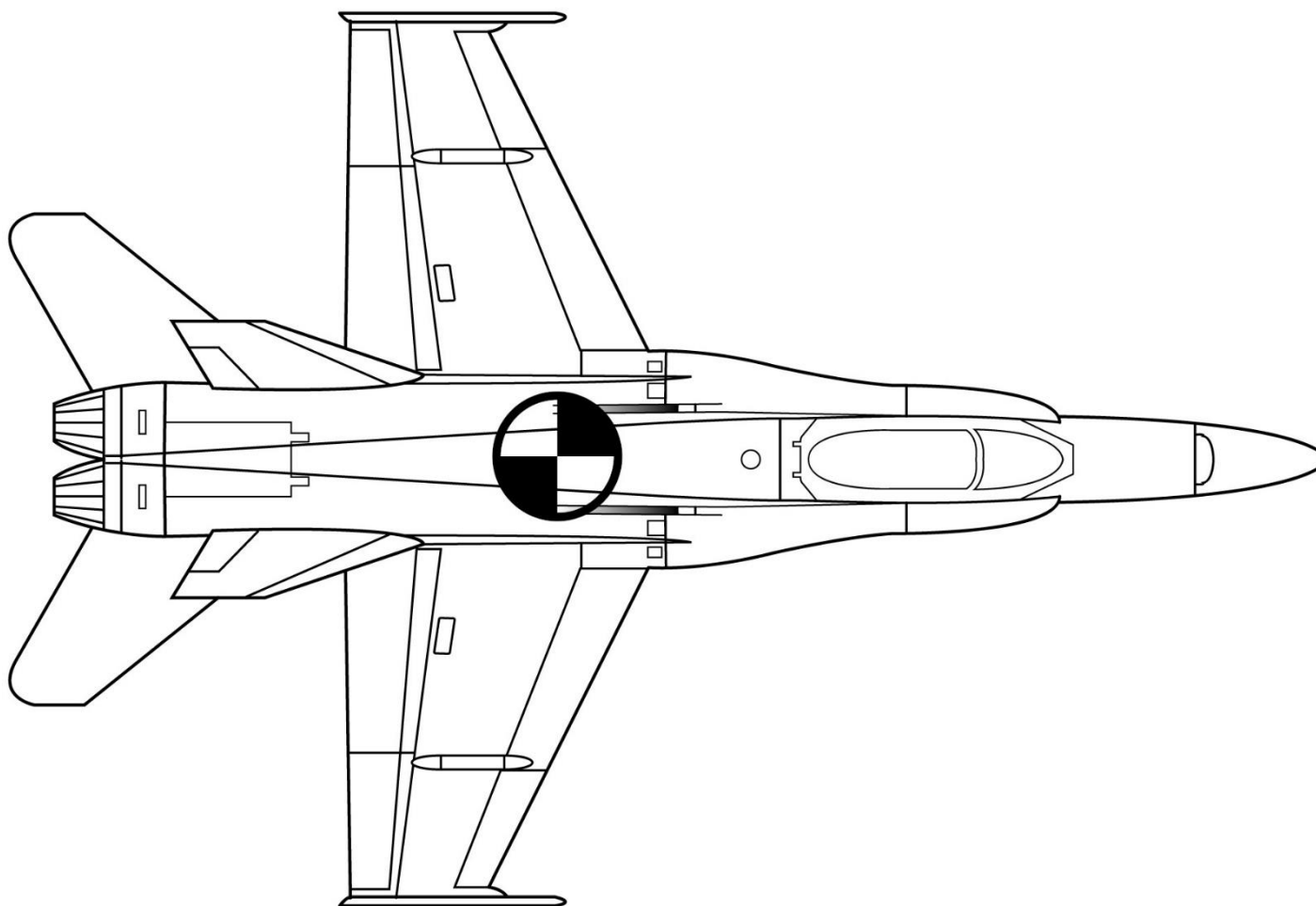


DCS F-18C PERFORMANCE EXAMPLE



1-INTRODUCCION.

An airplane load sheet has usually two parts:

-The first one is concerning weights: The two most important phases of the flight we have to be aware of, are the take-off and landing. Some more calculations are needed for planification purposes: we have to know what is the optimum climb speed and the altitude and speed for cruise for a given weight.

-The second one is concerning the position of the Center of Gravity (COG). The center of gravity of an airplane is constantly changing, due to fuel consumption, stores loaded and stores dropped. This is an imaginary point where the sum of the total weight of the airplane is supposed to be. The Center of Lift is the point where the lift forces is supposed to act. It is slightly aft of the COG. This COG is measured by a percentage of the meaning aerodynamic chord (MAC). If we load the plane to the rear of this point, the COG will be displaced aft, and all the loads in front of this point will cause the COG to be displaced forward.

Using this document, we will learn to calculate the weight of the plane, the drag created by those loads (DI, Drag Index) and the position of the Center of Gravity. This last part will be useful for determinating the take-off speeds.

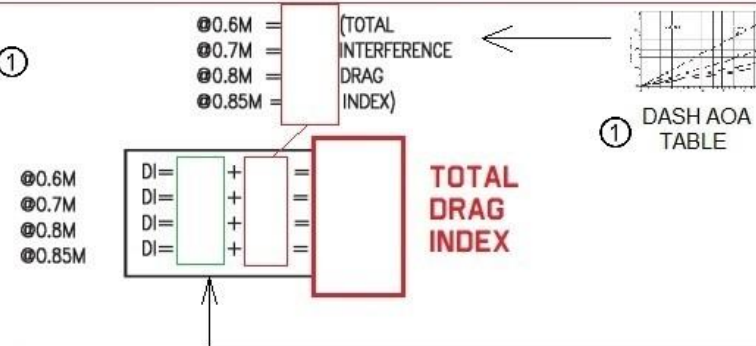
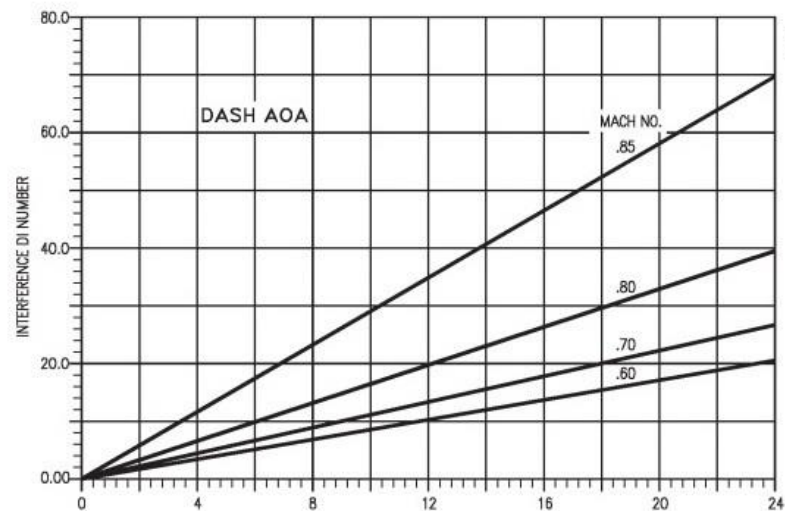
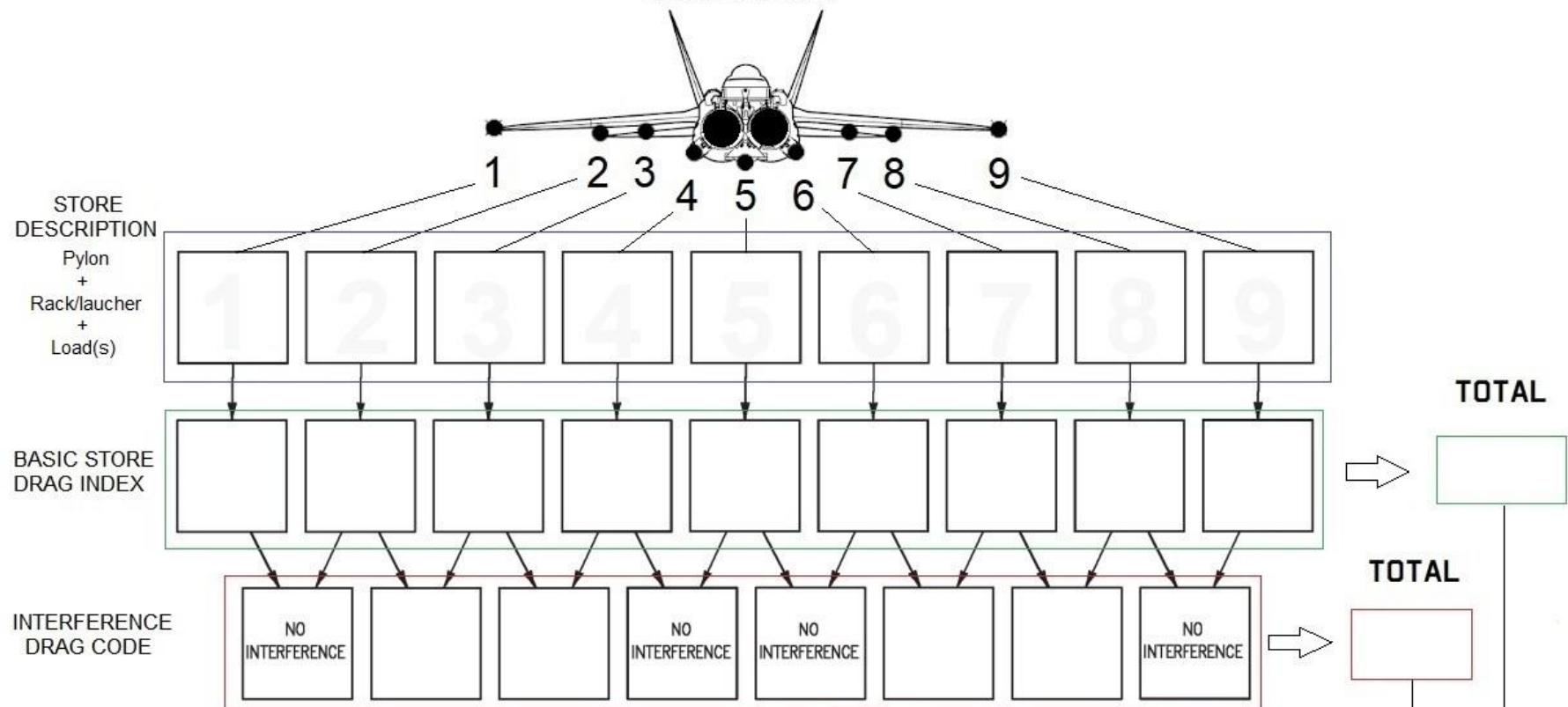
We have to start from a known data provided by the manufacturer. The empty weight of the plane, the position of the generic position of the COG of the plane, and the real position of the COG of my specific plane (not necessarily matches, all the “same” type planes have different empty weight and COG position). Manufacturing is not so perfect at that level.

The standard weights for F-18C DCS are:

-Basic Empty Weight:	25,093 lb.	Zero internal fuel and without pylons and no gun rounds.
-Dry Operating Weight1:	25,424 lb.	Zero internal fuel, w/o pylons and load of 578 gun rounds (100%).
-Dry Operating Weight2:	26,939 lb.	Zero internal fuel, with all 5 pylons and 100% gun rounds.

DRAG INDEX COMPUTATION - DCS F-18C

(View from behind)



2-DRAG INDEX: See the picture above full of empty squares? Don't panic yet. We will fill all those fields, it's no so complicated. Let me explain.

The picture you see on previous page comes from real Performance Manual and was created for Drag Index purposes only.

First of all, we have to know what type of loads we desire to be carried. The first row of the upper form is for filling the description of ALL components we are loading: "ALL" means the pylon plus the launcher plus the bomb, missile, or whatever is hanged under the station.

We will use this configuration as an example:



- 2x AIM-9M on stations 1 and 9,
- 2x AGM-88C HARMs on stations 2 and 8. Each stations has its LAU-118 and pylon. (WP=wing pylon)
- 8x GBU-12s on stations 3 and 7. Each stations includes the VER (vertical ejector rack) and the pylon.
- 1x ATFLIR on station 4,
- 1x 330 gal. fuel tank on station 5 under its centerline pylon (CLP=Centerline pylon), and
- 1x AIM-120C on station 6.

We annotate that on the first row of the form.

Using the right column of the SPOC document, we will find the BASIC store drag index for each component (black bold).

We annotate all those indexes on the second row (each component individually) and we put the total on the right side.

Finally, we will need to know the interference code. This is due to the interference of between some loadings due to the proximity of each other. That happens between both stations under the wing and between the inboard wing station and its nearby cheek station.

For calculating that the NATOPS **A1-F18AC-NFM-200** performance manual is needed. See Figure 11-3 and find the stores.

Annotate this on the third row. This interference drag is related to the speed. We need to find the Interference Drag Index for different speeds (Mach 0.6, 0.7, 0.8 and 0.85) using the DASH AOA table included on the bottom left side of the form.

This is the final result:

DRAG INDEX COMPUTATION - DCS F-18C

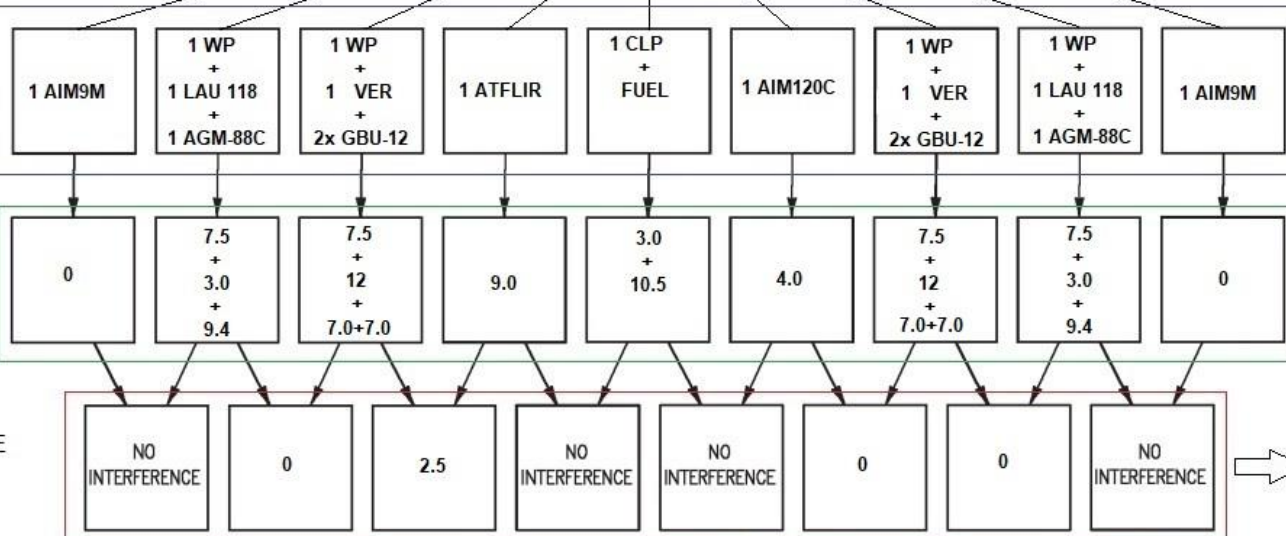
(View from behind)

STORE
DESCRIPTION

Pylon
+
Rack/launcher
+
Load(s)

BASIC STORE
DRAG INDEX

INTERFERENCE
DRAG CODE

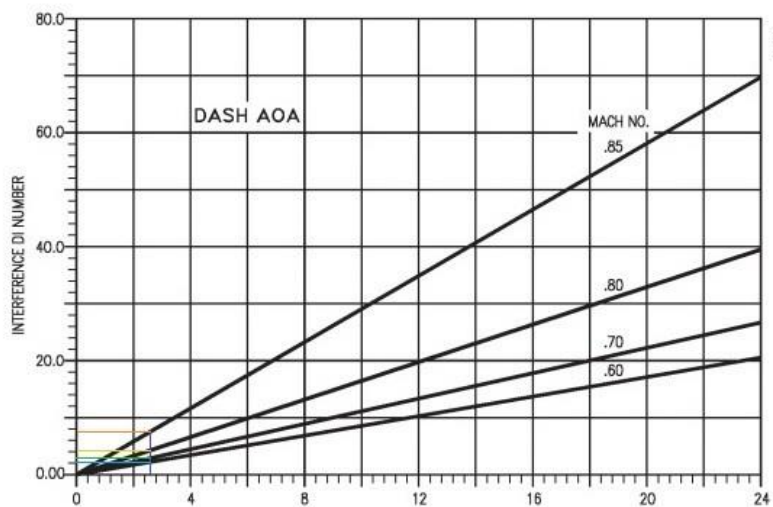


TOTAL

133.3

TOTAL

2.5



@0.6M = 2,0
 @0.7M = 2,9
 @0.8M = 4,0
 @0.85M = 7,8
 (TOTAL INTERFERENCE DRAG INDEX)

① DASH AOA TABLE

@0.6M
 @0.7M
 @0.8M
 @0.85M

DI = 133.3 + 2,0 = 135,3
 DI = 133.3 + 2,9 = 136,2
 DI = 133.3 + 4,0 = 137,3
 DI = 133.3 + 7,8 = 141,1

TOTAL DRAG INDEX

3-WORK SHEET: The work sheet is also known as the load sheet.

Using the SPOC document (central column), we will find the **weight** of each component and we will annotate that on the first row of the form, and the total weight on the right side.

On the second row, we will put the **% MAC** changes for each component. Find them also on the SPOC document, right column, purple characters. Be careful because there are positive and negative numbers and varies according each pylon position. We will put as usual the total on the right side.

After that we use this number for correction of the actual COG.

-There is a generic position of the COG for each aircraft series. For all the lot 20 units is 22.3%.

-In real life, the actual weight and position of the COG of each simple aircraft is slightly different from the generic, but we will take this easy, we are on a computer and our aircraft matches exactly this theoretical position; so our Hornet has its COG at 22.3 % MAC.

-Well, we can only have to calculate the correction for internal fuel. We also just have calculated the store's correction. For fuel there is a table on Aircraft Manual (Fig 11-17). For lot 20, 100% fuel weights around 10.800 lb, and locates the COG at 22.5 % MAC.

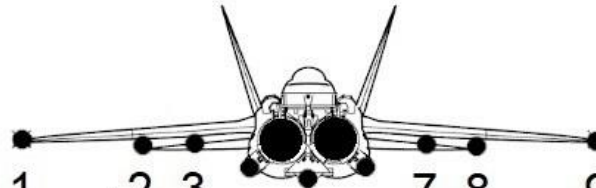
We will talk about asymmetric loadouts in an upcoming document.

And that's it. We have all the calculations we need for computing the take-off speeds. Enjoy and fly safely.

This is the final result for this example:

WORK SHEET - DCS F-18C

(View from behind)



	1	2	3	4	5	6	7	8	9	
+ GUN ROUNDS										
WEIGHT (LB)	331	187	(WV 311) + 100 + 795	(WV 311) + 201 + 611+611	(LAU 65) 364	(CLF 141) + 2535	(LAU 65) 355	(WV 311) + 201 + 611+611	(WV 311) + 100 + 795	187
% MAC CHANGE	(-2.0 loaded)	0.2	0.1 + 0.0 + -0.03	0.1 + -0.05 + -0.05-0.05	0.1	-0.2 + -2.4	0.3	0.1 + -0.05 + -0.05-0.05	0.1 + 0.0 + -0.03	0.2
										TOTAL
										-3.76

DRY WEIGHT:
25,093 LB

+ TOTAL STORES WGT
10,110 LB

+ INTERNAL FUEL
(10,803 full)
10,803 LB

↓
TOTAL ACTUAL WEIGHT
46,006 LB

(LOT 20)

Unique center of gravity: **22.3%**

Reference center of gravity: **-22.3%**

Stores CG change: **-3.76**

Internal Fuel CG *(22.5 full)*: **22.5**

Total % MAC: **18.74**

Assymetric Loads *(field take-off limit: 22,000 ft-lbs)*: **0.0** ft-lbs.

minus (-) = left wing heavier
plus (+) = right wing heavier

TRIM *(lighter wing down, units)*: **0**