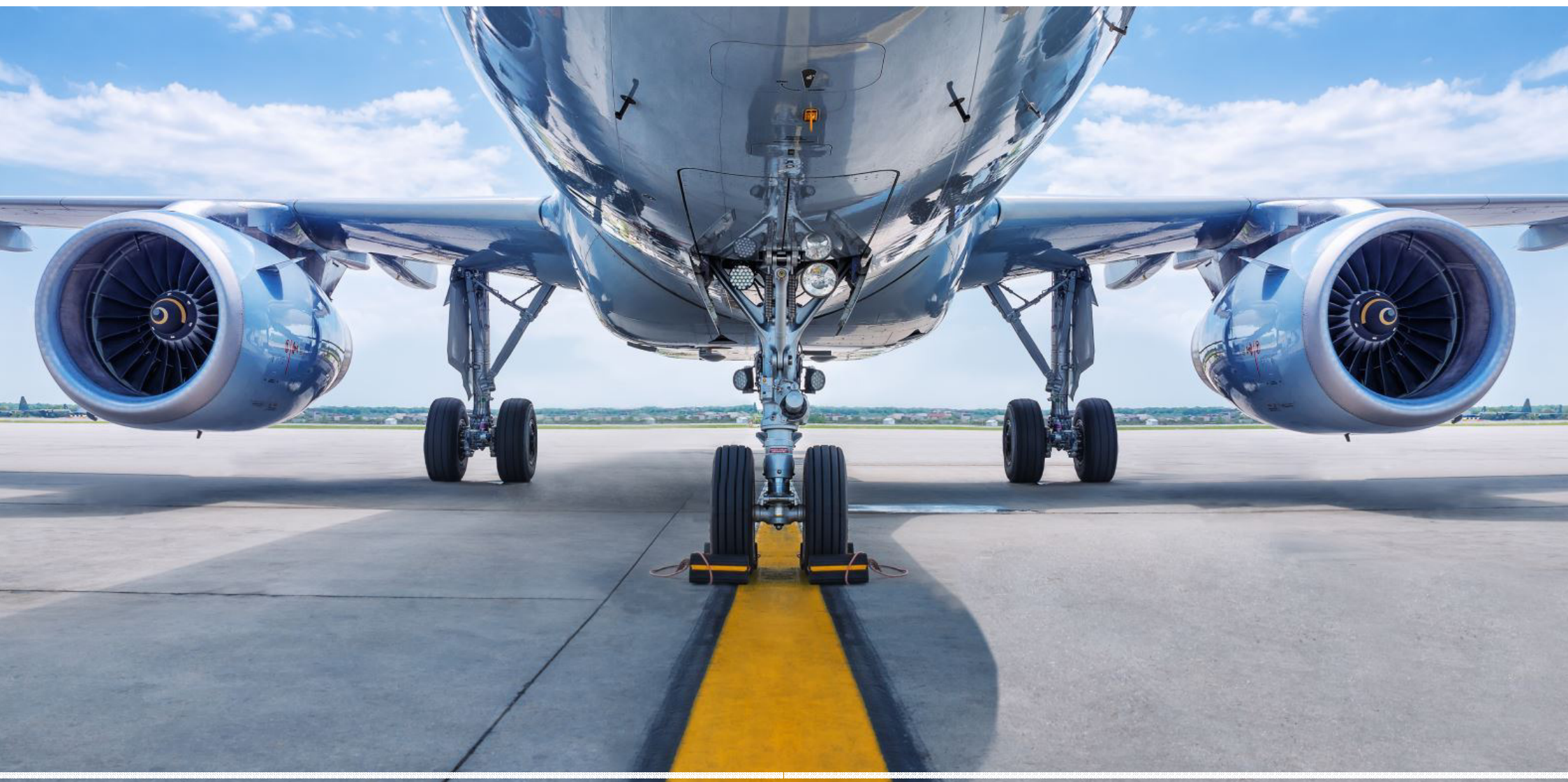
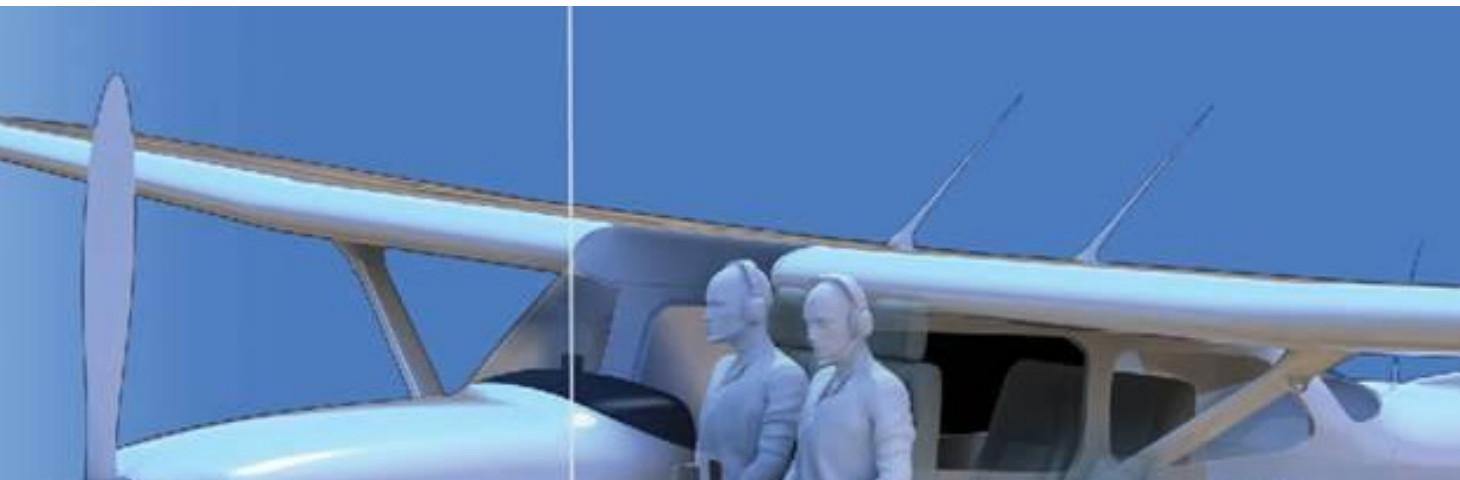




Weight & Balance in de luchtvaart



Centre of Gravity



Het belang van balans





Doel Loadsheet

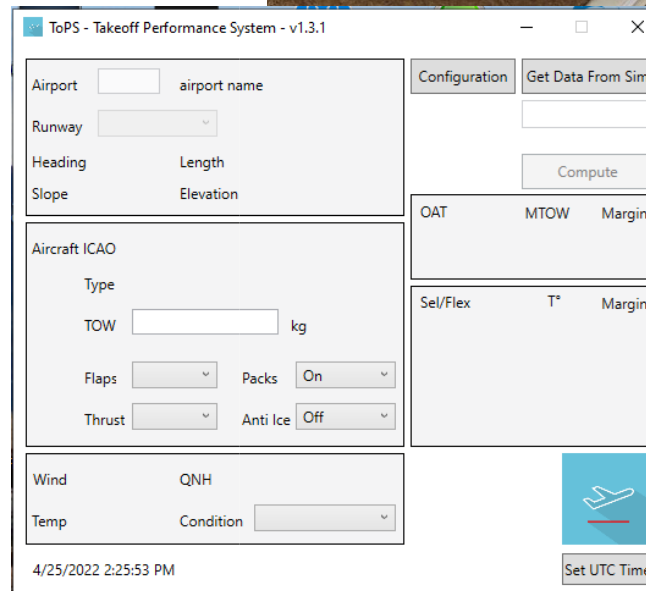
Loadsheet is een overzicht schema, waar van vernomen kan worden, hoe de ligging is van het toestel wanneer deze :

- Leeg is
- Op Take-off
- Tijdens Landing (Touch)

Het doel er van, waar het uiteindelijk om gaat, is om af te lezen of het toestel binnen zijn limits ligt. Voornamelijk met T/O en ZFW. Dit is af te lezen in het Trim Envelop. Nader meer uitleg. Deze moet ten alle tijden binnen de lijnen blijven van MTOW, MZFW en MLDW (Max Take-off, Zero Fuel en Landing Weight). Mocht de index er buiten liggen, kan toestel niet VEILIG vertrekken en kan dit fatale gevolgen hebben voor zowel crew, als voor Toestel en PAX (Passagiers) etc.

Tools bij berekenen van brandstof

- Little Nav Map
- SimBrief by Navigraph
- Professional Flightplanning X
- TopCat (www.flightsimsoft.com)
- TopS (gratis) (www.simflight.com)

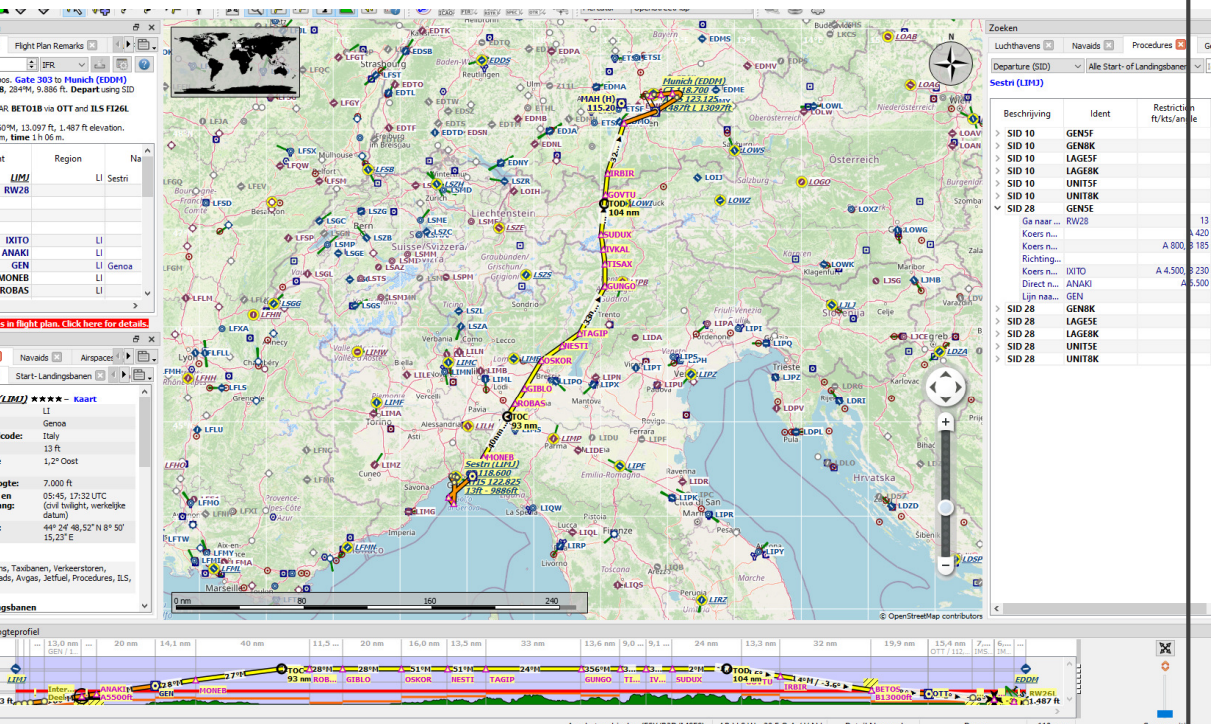


ToPS - Takeoff Performance System - v1.3.1

Airport	airport name	Configuration	Get Data From Sim
Runway			
Heading	Length		
Slope	Elevation		
Aircraft ICAO		OAT	MTOW
Type		Margin	
TOW	kg		
Flaps	Packs	Sel/Flex	T*
Thrust	Anti Ice	Margin	
Wind	QNH		
Temp	Condition		

4/25/2022 2:25:53 PM

Set UTC Time



Little NavMap

Professional Flight Planner X

www.flightsimsoft.com

Professional Flight Planner X

Schedule TRAA EHAM-EDDB Traffic Browser

Compute In-Flight Reset New Take-Off Landing None Maximum Random APU Inflight Edit Find Load Save Restrictions Validate Export Find Take-Off Enroute Auto Edit Disable Icing Disable

TRAA | PH-HSA | EHAM (SCHIPHOL, Netherlands) - EDDB (BERLIN BRANDENBURG, Germany) Compute Flight

General Advanced

Flight number HV Callsign TRA A From AMS EHAM To BER EDDB Take-Off Rwy 27 Landing Rwy 25R Taxi Out 10 min Taxi In 5 min

Dispatch remarks Flight INT Type N Date 19-Apr-2022 STD 13:40LT ETD STA 15:00LT EET 13:00 01:20

Aircraft

Registration/Tail Nr PH-HSA Type B737-800 CF Configuration Standard Weight adjust Empty Weight 41.145 kg Max Take-Off 78.800 kg Max Landing 66.360 kg

Climb 250/280/78 Cruise/Cost Index LRC Descent 78/280/250 Cruise Altitude/FL OPT Step Climb 2.000 ft Max Altitude/FL FL410 Optimize Altitude/FL Min Cost

Payload

Adults 154 Children Infants PaxCap 189 Baggage 2.002 kg Cargo Payload 13.706 kg Zero Fuel 54.851 kg Max Zero Fuel 61.689 kg

Fuel ICAO | Minimum Fuel

Costs Not Available

Route

Ident EHAMEDDB-MDT Min Alt/FL Max Alt/FL Circuit Out Circuit In Great Circle Dist 320.3 nm Flightplan Dist 421.8 nm Dist Inc 32.0%

Route ARNE3P ARNEM L620 SUV0X Z718 OSN L980 M0BSA DCT BATEL T207 OGBER OGB25R

Remarks

Alternates

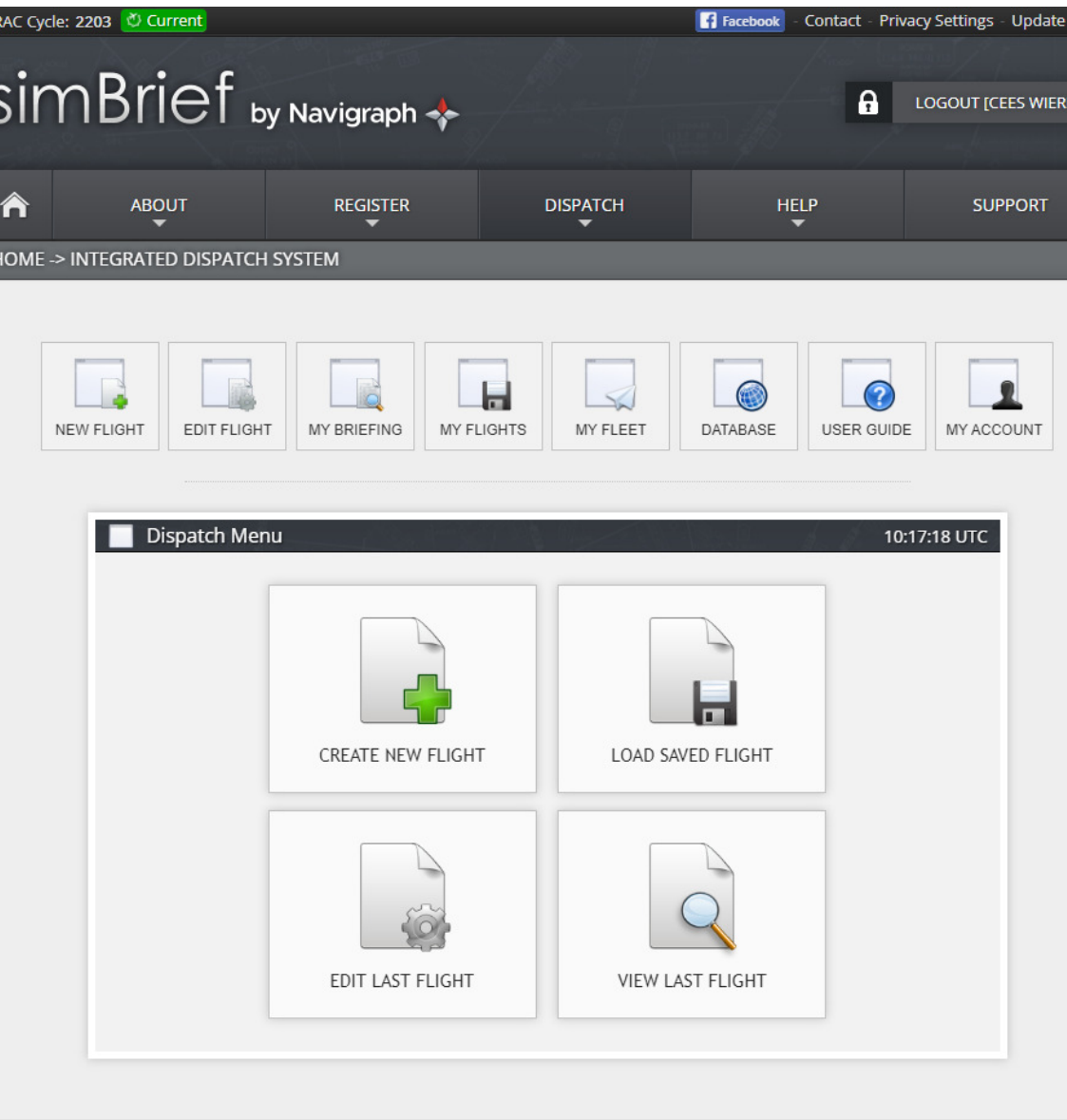
Altns required	Priority	1st Alternate	2nd Alternate	Take-Off Altn	PNR Airport	PNR Hold	
One	Fuel	(Auto)					
Destination Altn	Runway	Route	Altitude/FL	Hold Time	Circuit Out	Circuit In	FP Distance
EDON	26	DCT	OPT				40.2 nm
EDCY	21	DCT	OPT				56.4 nm
EDOV	26	SUK11A SUKIP Y206 BUREL M736 IND...	OPT				168 nm
EDDP	26R	LOGD1A LOGDO Z20 KENIG T959 KOJ...	OPT				182 nm

Adequate airports
EHAM EDON EDDB

World Map

FL300 19/11:08

Now Play



SimBrief

HOME -> INTEGRATED DISPATCH SYSTEM

NEW FLIGHT

EDIT FLIGHT

MY BRIEFING

MY FLIGHTS

MY FLEET

DATABASE

USER GUIDE

MY ACC

Dispatch Options10:22:22 UTC

GENERATE FLIGHT

NEW FLIGHT

SAVE FLIGHT

CLOSE FLIGHT

Flight Info

Airline

Flight-No.

Depart

Arrive

Alternate

Date

Depart (Zulu)

ZZZ

1000

ZZZZ

ZZZZ

AUTO

19APR22

10:55

Aircraft Type

Sort custom airframes by:Registration

Airframe:

Open Aircraft Editor

Advanced Aircraft Options

Climb Profile

Cruise Profile

Descent Profile

Fuel Factor

Registration

Fin Number

SELCAL Code

ATC Callsign

AUTO

AUTO

AUTO

P00

N999SB

999

NONE

ZZZ1000

Optional Entries

(fields are automatically calculated, but can be overridden)

Sched Flight Time

Departure Rwy

Arrival Rwy

Taxi Out / Taxi In

Extra Fuel

Altitude

SelectionsSave Default

OFFP Layout:

Units:

Cont Fuel:

Reserve Fuel:

Detailed Navlog:

ETOPS Planning:

Plan Stepclimbs:

Runway Analysis:

NOTAMS:

FIR NOTAMS:

Flight Maps:

LIDO

KG

AUTO

AUTO

Detailed

Simbrief

Loadsheet voor een PMDGB738

[OFP]

TRA052B 21FEB2022 LIMJ-EDDM B738 N806SB RELEASE 1821 21FEB22
OFP 2 SESTRI-MUNICH

WX PROG 2118 2121 2200 OBS 2112 2112 2112

ATC C/S TRA52B LIMJ/GOA EDDM/MUC CRZ SYS CI 14
21FEB2022 N806SB 1855/1915 2019/2027 GND DIST 345
B737-800 / CFM56-7B26 STA 2020 AIR DIST 368

CTOT:....

MAXIMUM TOW 79016 LAW 66361 ZFW 62732
ESTIMATED TOW 64695 LAW 61889 ZFW 58114

G/C DIST 266
AVG WIND 338/042
AVG W/C M022
AVG ISA M003
AVG FF KGS/HR 2621
FUEL BIAS P05.0
TKOF ALTN

ALTN EDDF
FL STEPS LIMJ/0300/IVKAL/0360

DISP RMKS NIL

PLANNED FUEL

FUEL	ARPT	FUEL	TIME
TRIP	MUC	2806	0104
CONT 15 MIN		655	0015
ALTN	FRA	2046	0046
FINRES		1074	0030

MINIMUM T/OFF FUEL 6581 0235

EXTRA 0 0000

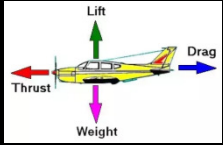
T/OFF FUEL 6581 0235
TAXI GOA 227 0020

BLOCK FUEL GOA 6808
PIC EXTRA
TOTAL FUEL
REASON FOR PIC EXTRA

MEL/CDL ITEMS DESCRIPTION



Weight and performance

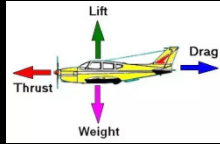


- Gewichts effecten op performance.
- Brandstof behoefte

Lamama 25 april 2022



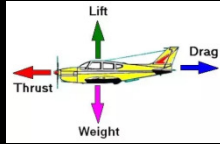
Weight and performance



BRANDSTOF		- 📐 ✕	
BRANDSTOF WEERGEVEN ALS		GAL ☒ POND	
^ BRANDSTOF		<input type="range" value="100"/>	100,00 %
HOOFD LINKS	<input type="range" value="100"/>	100	167.99 pond
HOOFD RECHTS	<input type="range" value="100"/>	100	167.99 pond
^ LAADVERMOGEN		<input type="range" value="96.05"/>	96,05 %
PILOOT			170 pond
COPILOOT			170 pond
PASSAGIER LINKS			170 pond
PASSAGIER RECHTS			0 pond
VRACHT			0 pond
Leeg gewicht / -		1.691 POND / -	
Brandstof / Max. toegestane brandstofhoeveelheid		336 POND / 336 POND	
Laadvermogen / Max. laadvermogen		510 POND / 531 POND	
Totaal / Max. startgewicht		2.537 POND / 2.558 POND	
Verbruik en CO2-uitstoot			

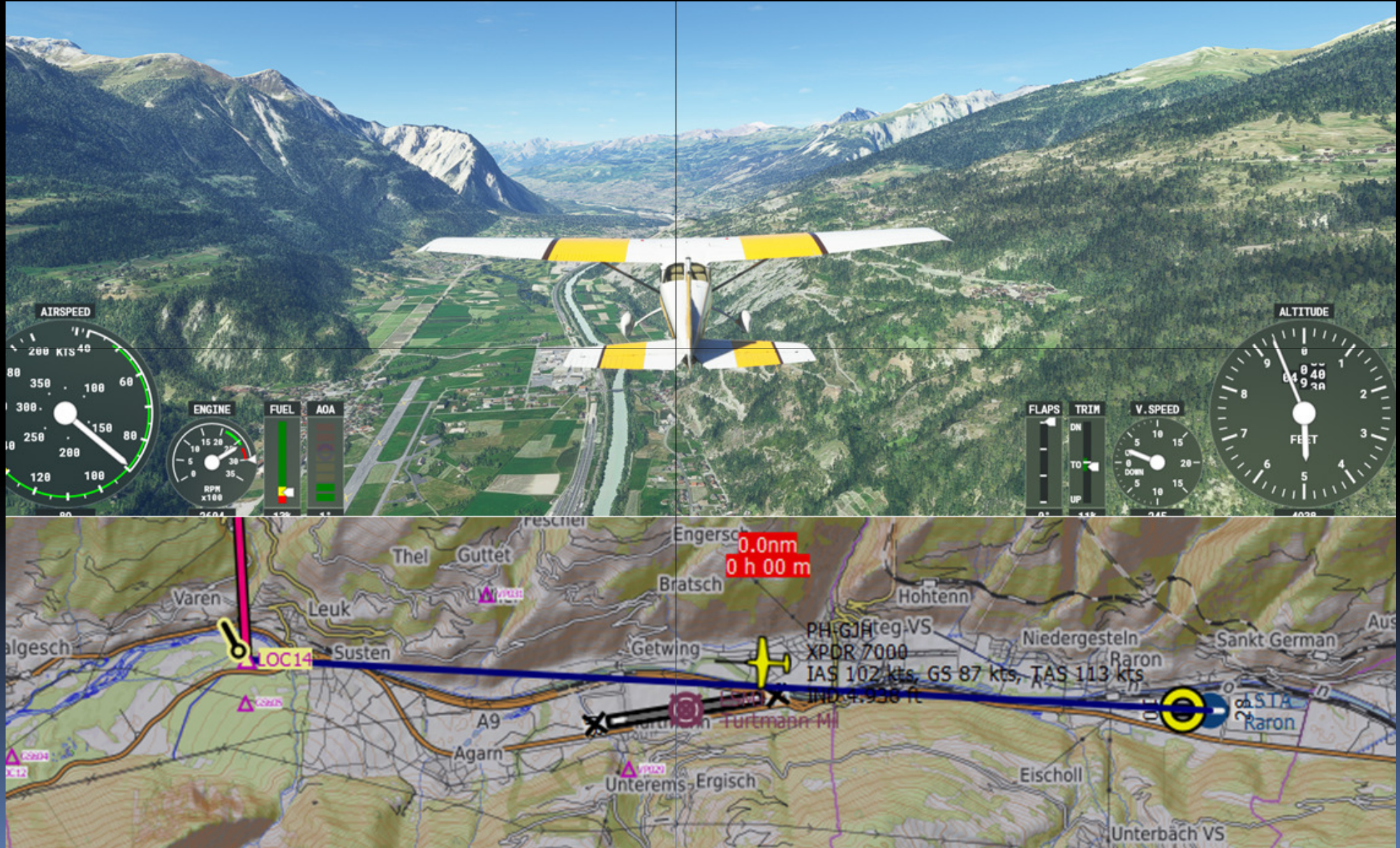
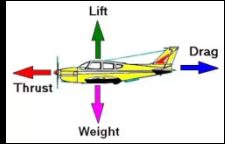


W&P C172 max. zwaar



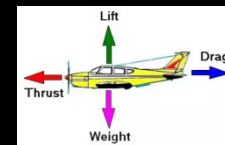


W&P C172 licht

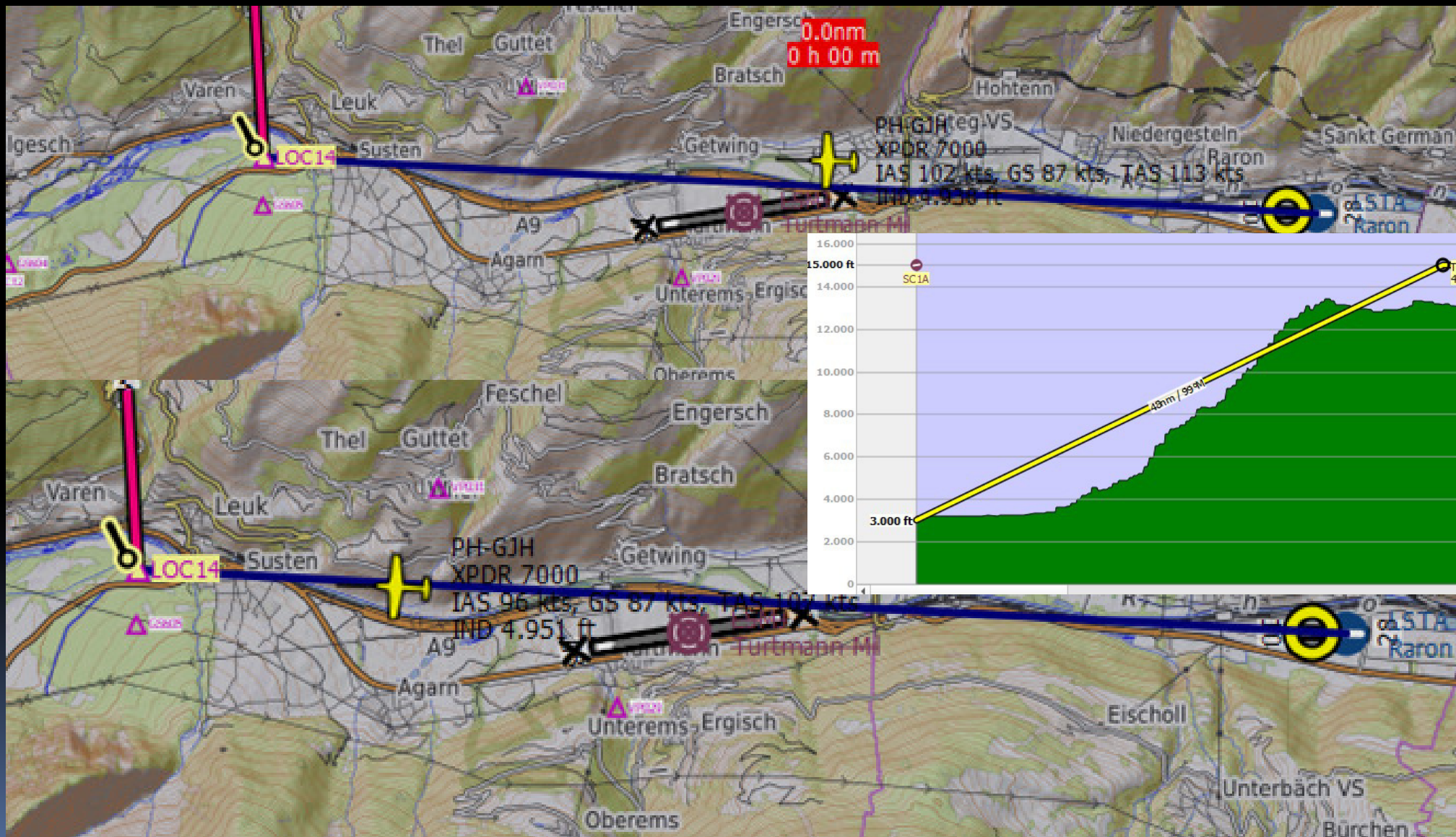




W&P C172



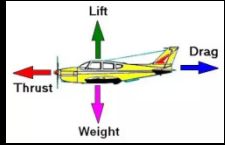
Licht



Zwaar



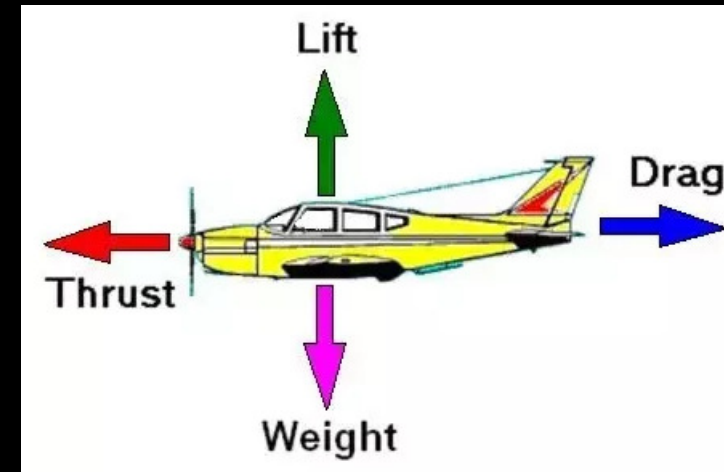
Weight and performance



Gevolgen van (te) veel gewicht:

- Verticale stijgsnelheid is lager.
- Hogere neusstand bij landing
- Vliegtuig manoeuvreert lastiger.
- Meer brandstof verbruik.
- Hogere startsnelheid
- Hogere landingsnelheid

Stall speed is " V_s "



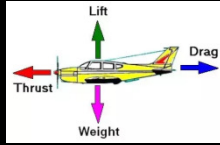
Normaal = $15\% > V_s$

ca. $1.3V_s$

-Stall speed is hoger. Verlies lift in een bocht. $+10\%$ gewicht = $V_s + 5$



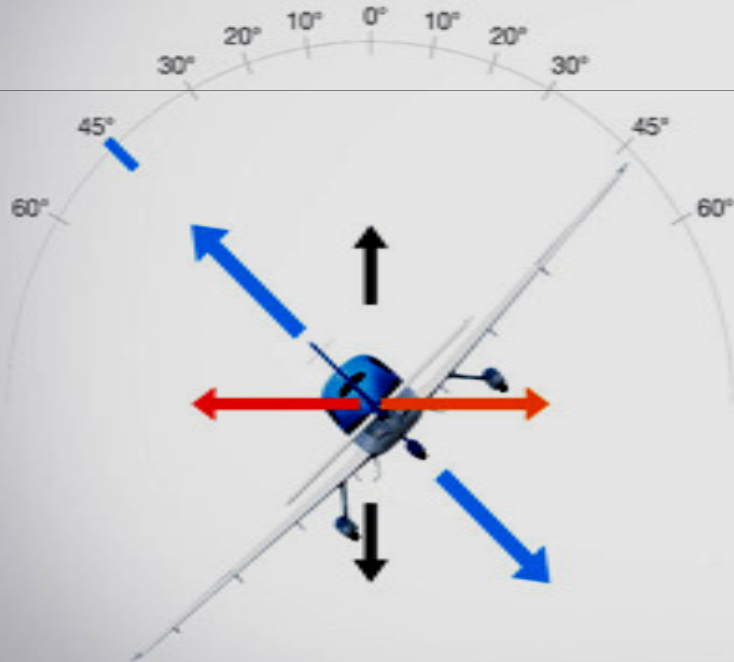
Weight and performance



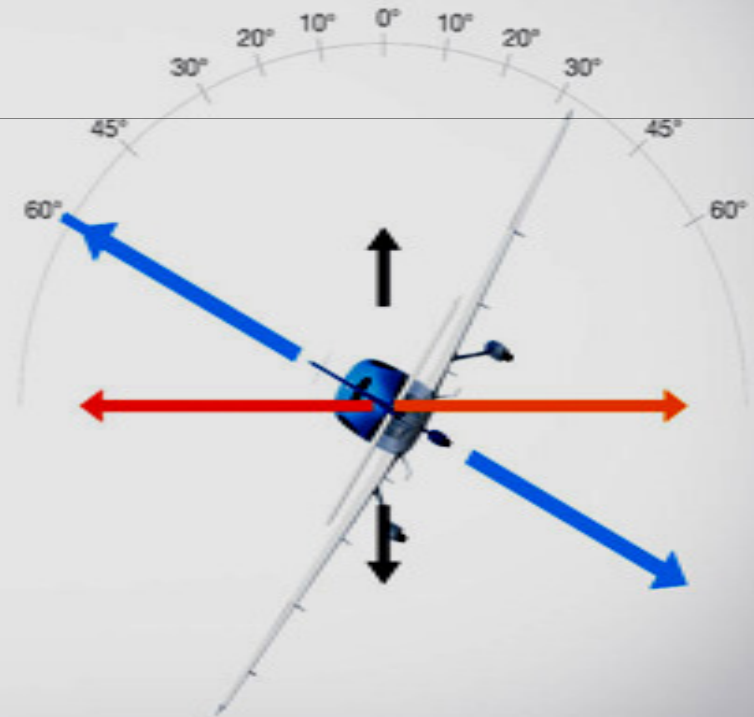
Stall speed in bochten

+10% gewicht = V_{s+5}

45° bank = 20% increased stall speed

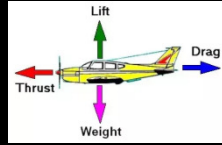


60° bank = 40% increased stall speed





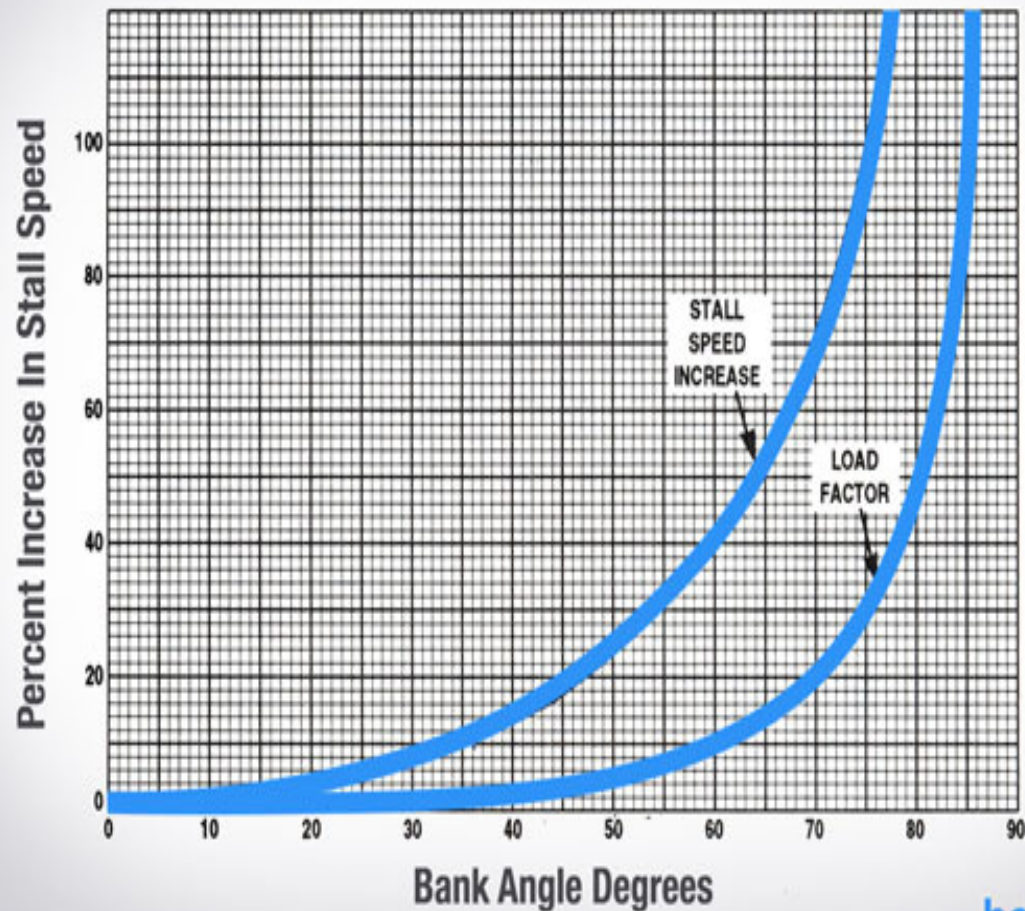
Weight and performance



Stall speed in bochten

+10% gewicht = $V_s + 5$

Stall Speed And Load Factor



Circuit vliegen met Beech 58

-Beech 58 Stall speed (V_s) = 80Kn. Full Flaps

Negatieve invloeden:

-Max. beladen = $V_s + 10$ Kn

-Circuit-Bocht $30^\circ = V_s + 10\%$

Gevolg:

- V_s wordt $80 + 10 + 10\% = 99$ Kn stall speed.

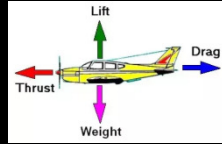
Ergo:

Zwaar beladen en een 30° bocht, dan minimaal 25Kn hogere snelheid aanhouden.

Heb je "Berekende brandstof" dan: $V_s + 0$



Weight and performance



Gewicht componenten:

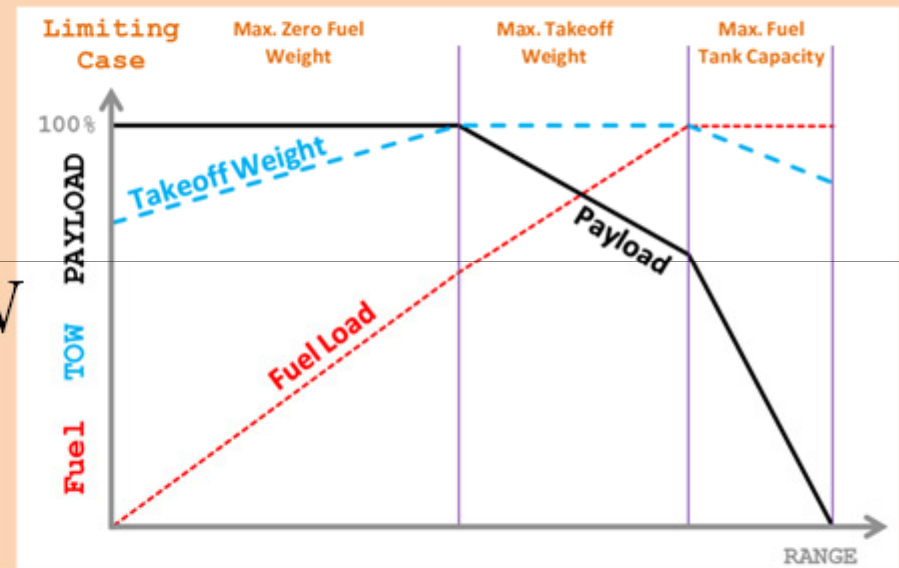
Vliegtuig leeg
Passagiers

Bagage
Brandstof

Payload

ZFW

MTOW





WERELDKAART

Textron Aviation Cessna 172 Skyhawk



VAN

SELECTEER LUCHTHAVEN VAN VERTREK

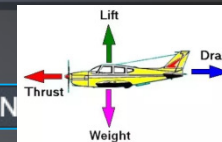


START-/LANDINGSBAAN



SELECTEER LUCHTHAVEN VAN

START-/LANDINGSBAAN



VLIEGTUIGSELECTIE

LIVREIEN

GEWICHT EN BALANS

STORINGEN

AANPASSING

BRANDSTOF WEERGEVEN ALS

GAL ☒ POND

^ BRANDSTOF

HOOFD LINKS

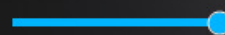


44

44,00 %

12.32 gal

HOOFD RECHTS



44

12.32 gal

^ LAADVERMOGEN

100,45 %

PILOOT

170 pond

COPILOOT

170 pond

PASSAGIER LINKS

170 pond

PASSAGIER RECHTS

106 pond

VRACHT

106 pond

Leeg gewicht / -

1.691 POND / -

Brandstof / Max. toegestane brandstofhoeveelheid

148 POND / 336 POND

Laadvermogen / Max. laadvermogen

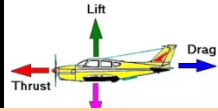
722 POND / 719 POND

Totaal / Max. startgewicht

2.561 POND / 2.558 POND



Fuel and performance



Brandstof:

Trip Fuel

Brandstof van A naar B

Alternate

Uitwijkhaven

Reserve

Minimale hoeveelheid

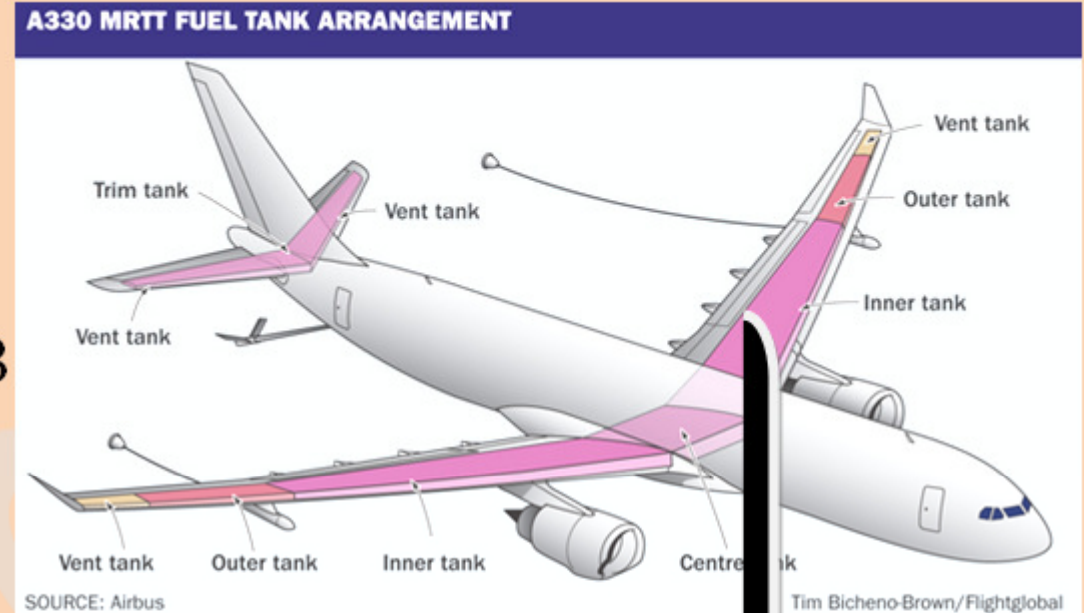
Taxi

Extra

2x een Holding van een half uur,
2x missed approach

Contingency

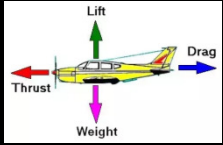
5% . ATC vectoring, geen optimale vlieghoogte,
omleiding stormcellen ect.



Block
Fuel



Fuel and performance



Onderdelen die brandstof hoeveelheid bepalen binnen LNM:

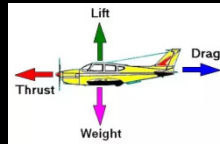
Flightplan - NOAA (het weer) - Performance file

Brandstof rapport
(fuel report)

Een performance file wordt per vliegtuig /type gemaakt.



Fuel and performance



Flightplan –
Fuel Report –
Aircraft performance file

Flight Planning

Flight Plan * x Fuel Report x Current Performance x

20,000 ft VFR

Chacalluta Intl (SCAR) Runway 02 to Canchones West (SC1A)
192 nm, 0 h 32 m, High Altitude

	Ident	Region	Name	Procedure
1	SCAR	SC	Chacalluta Intl	
2	WP2			
3	WP3			
4	WP4			
5	SC1A		Canchones West	
6	SCKP		Coposa	Alternate

SCAR Vertrek SC1A aankomt

Weather Userdata Logbook Aircraft Scenery Library Tools W

Airport Weather Source

Wind source

Disabled
Flight Simulator (X-Plane only)
NOAA

Flight Planning

Flight Plan x Fuel Report x Current Performance x

Manual Wind

Sarenado C90B King Air Japan Maritime Self

Aircraft

Fuel Type: Jetfuel

Usable Fuel: 1000 lbs, 149 gal

Estimated range with reserve: 413 nm, 2 h 06 m

Minimum runway: Hard and soft surface, 500 ft

Flight Plan

Distance and Time: 192 nm, 1 h 06 m

Average Ground Speed: 174 kts

True Airspeed at Cruise: 196 kts

Average wind (NOAA): 78°T, 17 kts
4 kts headwind

Fuel Plan

Trip Fuel: 486 lbs, 73 gal

Block Fuel: 896 lbs, 134 gal
90 % of usable Fuel

Fuel at Destination: 386 lbs, 58 gal

Alternate Fuel: 71 lbs, 11 gal

Reserve Fuel: 40 lbs, 6 gal

Taxi Fuel: 25 lbs, 4 gal

Extra Fuel: 250 lbs, 37 gal

Het "fuel" rapport is het resultaat van het

Little Navmap - Edit Aircraft Performance

Aircraft Performance Description or Comments

Labels of minimum required values for fuel calculation and elevation profile are **bold**.

Fuel

Fuel units: Weight (lbs) Fuel type: Jetfuel

Usable fuel: 1000 lbs

Estimated range with reserve: 413 nm, 2 h 06 m

Reserve fuel: 40 lbs

Taxi fuel: 25 lbs

Extra fuel: 250 lbs

Contingency fuel: 5 percent

Climb

Average climb speed: 161 kts true airspeed

Average vertical climb speed: 1,833 fpm ▲

Average fuel flow for climb: 804 lbs per hour

Cruise

Cruise speed at typical cruise altitude: 196 kts true airspeed

Fuel flow in cruise: 456 lbs per hour

Descent

Average descent speed: 154 kts true airspeed

Average vertical descent speed: -917 fpm ▼

Average fuel flow for descent: 194 lbs per hour

Descent Rule of Thumb: 2.8 nm per 1,000 ft.

Alternate

Average speed for alternate: 190 kts true airspeed

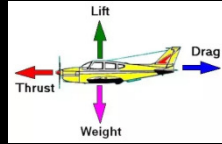
Average fuel flow for alternate: 436 lbs per hour

Reset Restore Defaults OK Cancel Help

Performance files kun je met de hand invullen of



Fuel and performance



Flight Planning

Flight Plan

Fuel Report

Flight Plan Remarks

Current Performance

☐ Manual Wind

Beech Baron 58 Paint2 - BE58

Aircraft
 Estimated range with reserve: 966 nm, 5 h 13 m

Flight Plan
 Distance and Time: 332 nm, 1 h 56 m
 Average Ground Speed: 171 kts
 True Airspeed at Cruise: 185 kts
 Average wind total (NOAA): No wind
 Average wind at cruise (NOAA): No wind

Fuel Plan
 Fuel Type: Avgas
 Usable Fuel: 1.164 lbs, 194 gal
 Trip Fuel: 366 lbs, 61 gal
 Block Fuel: 719 lbs, 120 gal
 62 % of usable Fuel
 Fuel at Destination: 351 lbs, 59 gal
 Alternate Fuel: 193 lbs, 32 gal
 Reserve Fuel: 40 lbs, 7 gal
 Taxi Fuel: 2 lbs, 0 gal
 Extra Fuel: 100 lbs, 17 gal
 Contingency Fuel: 5 %, 18 lbs, 3 gal

Climb and Descent
 Climb: 1,175 fpm at 130 kts, 6,0° Flight Path Angle
 Time to Climb: 0 h 27 m
 Descent: 995 fpm at 185 kts, -3,0° Flight Path Angle

Map

Little Navmap - Edit Aircraft Performance

Aircraft

Performance

Remarks

Labels of minimum required values for fuel calculation and elevation profile are **bold**.

Fuel
 Fuel units: Weight (lbs) Fuel type: Avgas
 Usable fuel: 1164 lbs
 Estimated range with reserve: 1,014 nm, 5h 29 m.

Reserve fuel: 40 lbs
 Taxi fuel: 2 lbs
 Extra fuel: 100 lbs
 Contingency fuel: 5 percent

Climb
 Average climb speed: 130 kts true airspeed
 Average vertical climb speed: 1,373 fpm
 Average fuel flow for climb: 239 lbs per hour

Cruise
 Cruise speed at typical cruise altitude: 185 kts true airspeed
 Fuel flow in cruise: 205 lbs per hour

Descent
 Average descent speed: 185 kts true airspeed
 Average vertical descent speed: -995 fpm
 Average fuel flow for descent: 143 lbs per hour
 Descent Rule of Thumb: 3,1 nm per 1,000 ft.

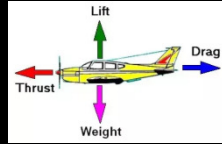
Alternate
 Average speed for alternate: 170 kts true airspeed
 Average fuel flow for alternate: 200 lbs per hour

Reset Restore Defaults OK Cancel Help

Brandstof rapport



Fuel and performance



Flight Plan X Fuel Report X Flight Plan Remarks X Current Performance X

☒ Manual Wind

Wind: 360 °T 90 kts

Beech Baron 58 Paint2 - BE58

Aircraft
Estimated range with reserve: 966 nm, 5 h 13 m

Flight Plan

Distance and Time:	332 nm, 3 h 05 m
Average Ground Speed:	108 kts
True Airspeed at Cruise:	185 kts
Average wind total (Manual):	0°T, 71 kts ▼ 67 kts headwind
Average wind at cruise (Manual):	0°T, 90 kts ▼ 88 kts headwind

Fuel Plan

Fuel Type:	Avgas
Usable Fuel:	1.164 lbs, 194 gal
Trip Fuel:	592 lbs, 99 gal
Block Fuel:	957 lbs, 159 gal 82 % of usable Fuel
Fuel at Destination:	363 lbs, 60 gal
Alternate Fuel:	193 lbs, 32 gal
Reserve Fuel:	40 lbs, 7 gal
Taxi Fuel:	2 lbs, 0 gal
Extra Fuel:	100 lbs, 17 gal

Map

Summary

Distance and Time:	332 nm, 1 h 56 m
Average Ground Speed:	171 kts
True Airspeed at Cruise:	185 kts
Average wind total (Manual):	No wind
Average wind at cruise (Manual):	No wind

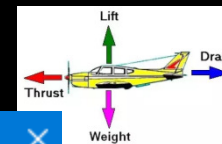
Fuel Plan

Fuel Type:	Avgas
Usable Fuel:	1.164 lbs, 194 gal
Trip Fuel:	366 lbs, 61 gal
Block Fuel:	719 lbs, 120 gal 62 % of usable Fuel
Fuel at Destination:	351 lbs, 59 gal
Alternate Fuel:	193 lbs, 32 gal
Reserve Fuel:	40 lbs, 7 gal
Taxi Fuel:	2 lbs, 0 gal
Extra Fuel:	100 lbs, 17 gal

Brandstof rapport



Fuel and performance



Beech 58



Little Navmap - Edit Aircraft Performance

Aircraft Performance Remarks

Labels of minimum required values for fuel calculation and elevation profile are **bold**.

Fuel

Fuel units: Weight (lbs) Fuel type: Avgas

Usable fuel: 1164 lbs

Estimated range with reserve 1.014 nm, 5 h 29 m.

Reserve fuel: 40 lbs

Taxi fuel: 2 lbs

Extra fuel: 100 lbs

Contingency fuel: 5 percent

Climb

Average climb speed: 130 kts true airspeed

Average vertical climb speed: 1.373 fpm ▲

Average fuel flow for climb: 239 lbs per hour

Cruise

Cruise speed at typical cruise altitude: 185 kts true airspeed

Fuel flow in cruise: 205 lbs per hour

Descent

Average descent speed: 185 kts true airspeed

Average vertical descent speed: -995 fpm ▼

Average fuel flow for descent: 143 lbs per hour

Descent Rule of Thumb: 3,1 nm per 1.000 ft.

Alternate

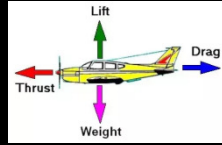
Average speed for alternate: 170 kts true airspeed

Average fuel flow for alternate: 200 lbs per hour

performance file



Fuel and performance



BP-48 : LNM 2.4 – Performance file & Brandstofberekening 20



Beste Piloten, Plempen of rekenen?

Elke kilogram die de lucht ingaat kost energie. Meer payload (passagiers/ladingen) resulteert in een hoger brandstof verbruik en veranderende vliegtuig prestaties.

Wat je als piloot moet weten is; de brandstof consequentie in relatie tot gewicht/ weersomstandigheden de route en de economische richtlijnen. Kortweg, hoeveel peut in de kist?



Hier zijn hele mooie tools voor die tot in detail alles in kaart kunnen brengen (Topcat) en vervolgens de piloot vertelt met welke instellingen en brandstof rekening gehouden moet worden. Maar die moet je dan wel hebben/kopen! Het FMC kan je hierbij ook goed helpen maar niet elk vliegtuig in onze vloot heeft dit dynamisch instrument.

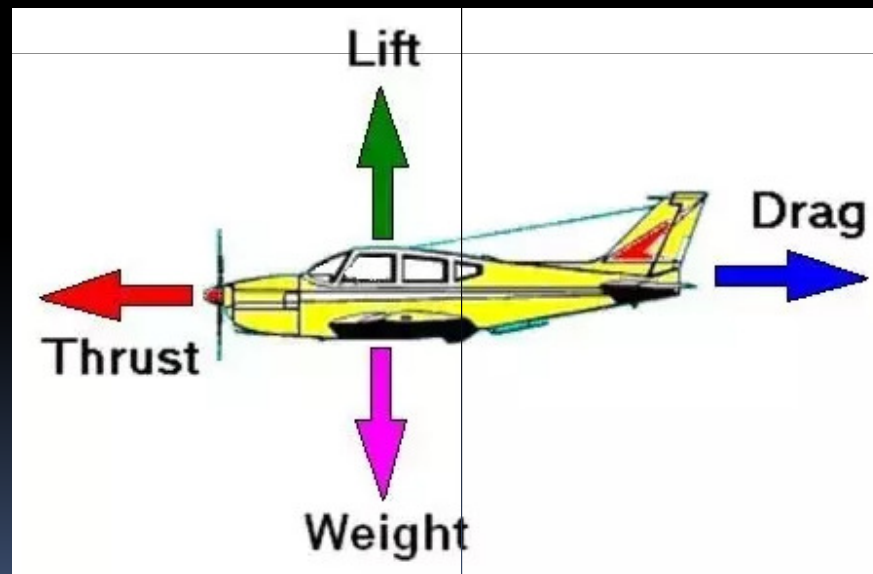
Dan is er nog de zgn. “rule of thumb”. Een simpele rekensom die de brandstof behoefte geeft. Voorbeeld: Boeing 737; $\text{Afstand in Nm} / 100 * 2200 + 5500$ geeft benodigde brandstof in lbs. Dit heeft als nadeel dat je altijd uit

veiligheidsoverwegingen met teveel brandstof gaat vertrekken en soms klopt het toch niet.

Einde presentatie

Brandstof/ gewicht performance en Balans

Cees & Gradus



25 april 2022