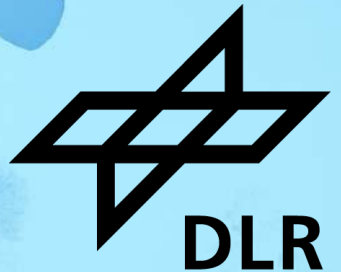


D250-TFLH2-MHEP-2040 EXACT

Daniel Silberhorn

06.12.2023



Acronym Definition

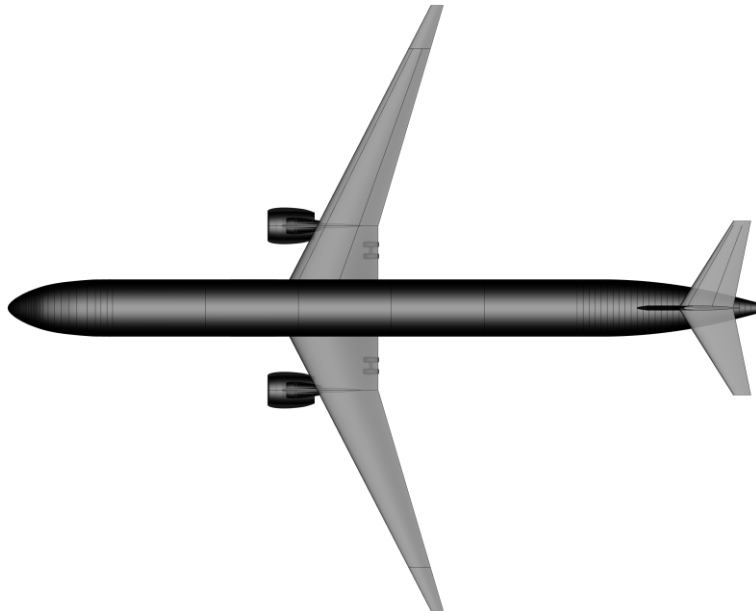
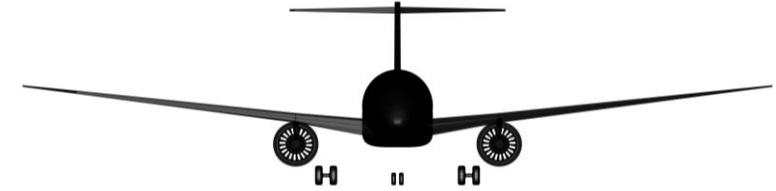
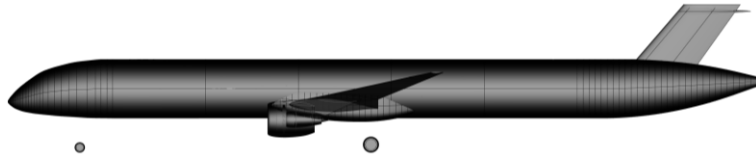
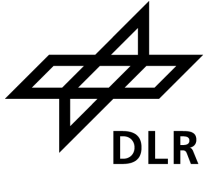


Acronym	Definition
A/C	Aircraft
AEO	All Engine Operating
AMC	Aircraft Mission Calculation
App	Approach
APU	Auxiliary Power Unit
Avg.	Average
BPR	Bypass Ratio
CAS	Calibrated Airspeed
CS 25	Certification Specifications for Large Aeroplanes
CFRP	Carbon-Fiber-Reinforced Polymers
CG	Centre of Gravity
CPACS	Common Parametric Aircraft Configuration Schema
DC	Drag counts
EIS	Entry Into Service
EOF	End of Field
FL	Flight Level
hAP	Airport Altitude
HiFi	High Fidelity

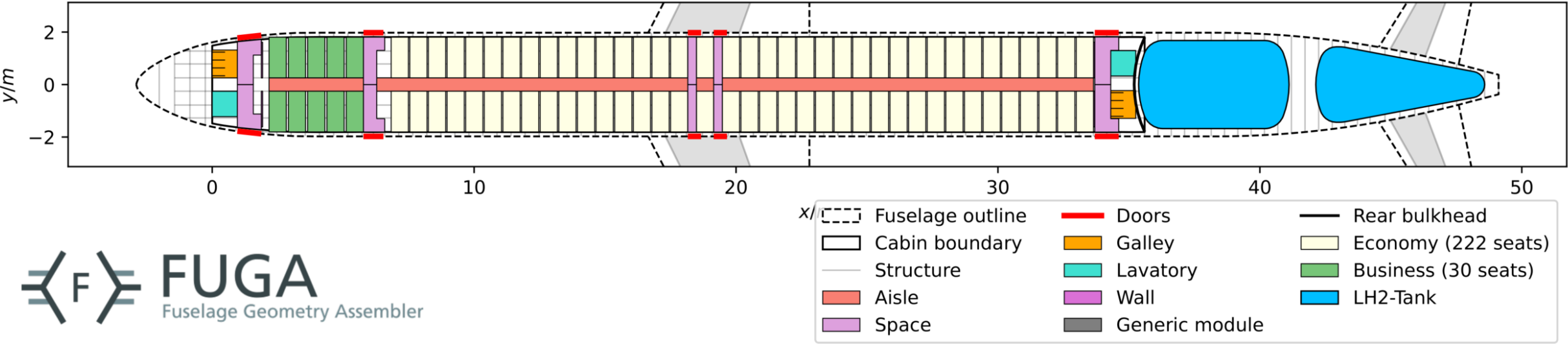
Acronym	Definition
HTP	Horizontal Tail Plane
ICA	Initial Cruise Altitude
ISA	International Standard Atmosphere
IPT	Intermediate Pressure Turbine
ITD	Intermediate Turbine Duct
JAR	Joint Aviation Requirements
klbf	Kilo Pound-Force
kn	Knots
LE	Leading Edge
LFL	Landing field length
LoFi	Low Fidelity
MCL	Maximum Climb Thrust
MCR	Maximum Cruise Thrust
MEM	Manufacturer Empty Mass
MLM	Maximum Landing Mass
MTO	Maximum Take-off Thrust
MTOM	Maximum Take-Off Mass
MZFM	Maximum Zero-Fuel Mass

Acronym	Definition
NM	Nautical Mile
OAD	Overall Aircraft Design
OEI	One engine inoperative
OEM	Operating Empty Mass
OPR	Overall Pressure Ratio
PAX	Passenger
RCE	Remote Component Environment
ROC	Rate of Climb
RTO	Reserve Take-off Thrust
RWY	Runway
SFC	Specific Fuel Consumption
SL	Sea Level
TE	Trailing Edge
TLARs	Top-Level Aircraft Requirements
TOC	Top of Climb
TSFC	Thrust Specific Fuel Consumption
VTP	Vertical Tail Plane

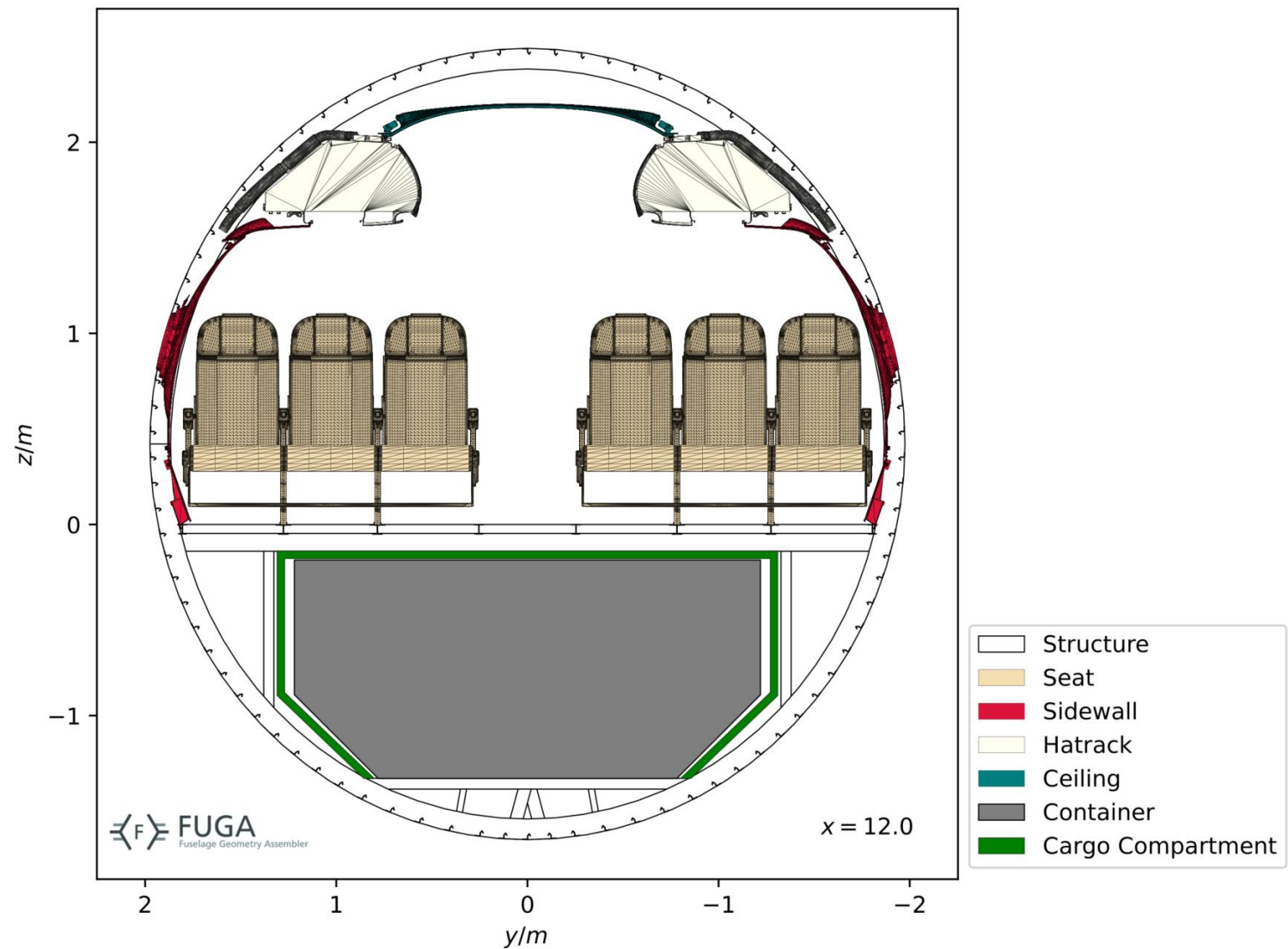
CPACS Output



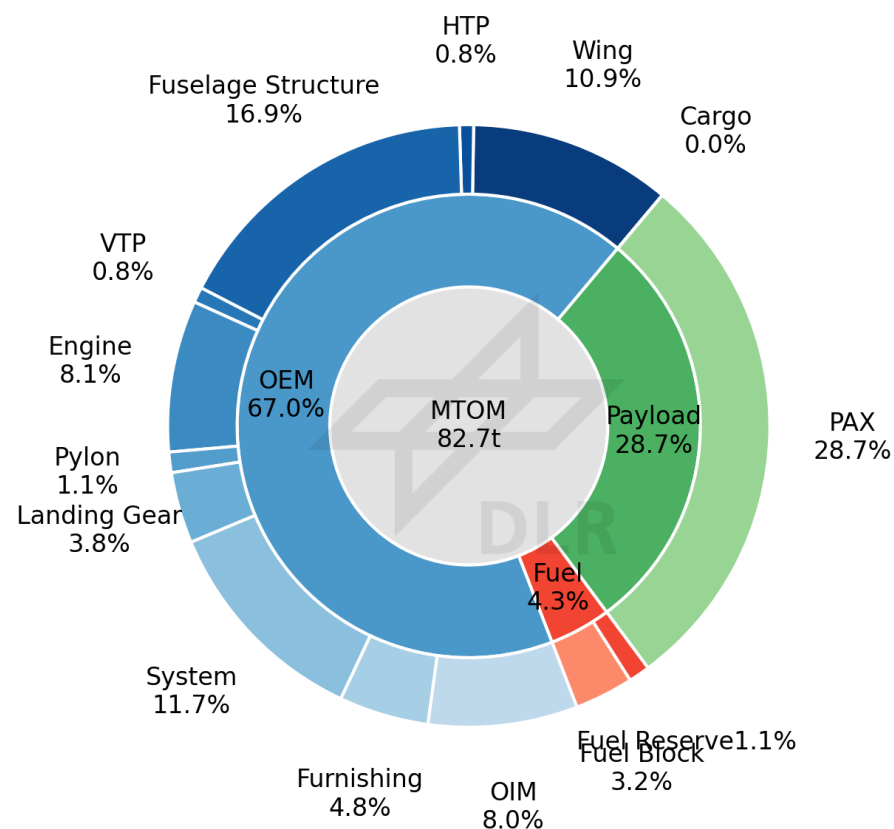
Cabin Layout



Cross-Section

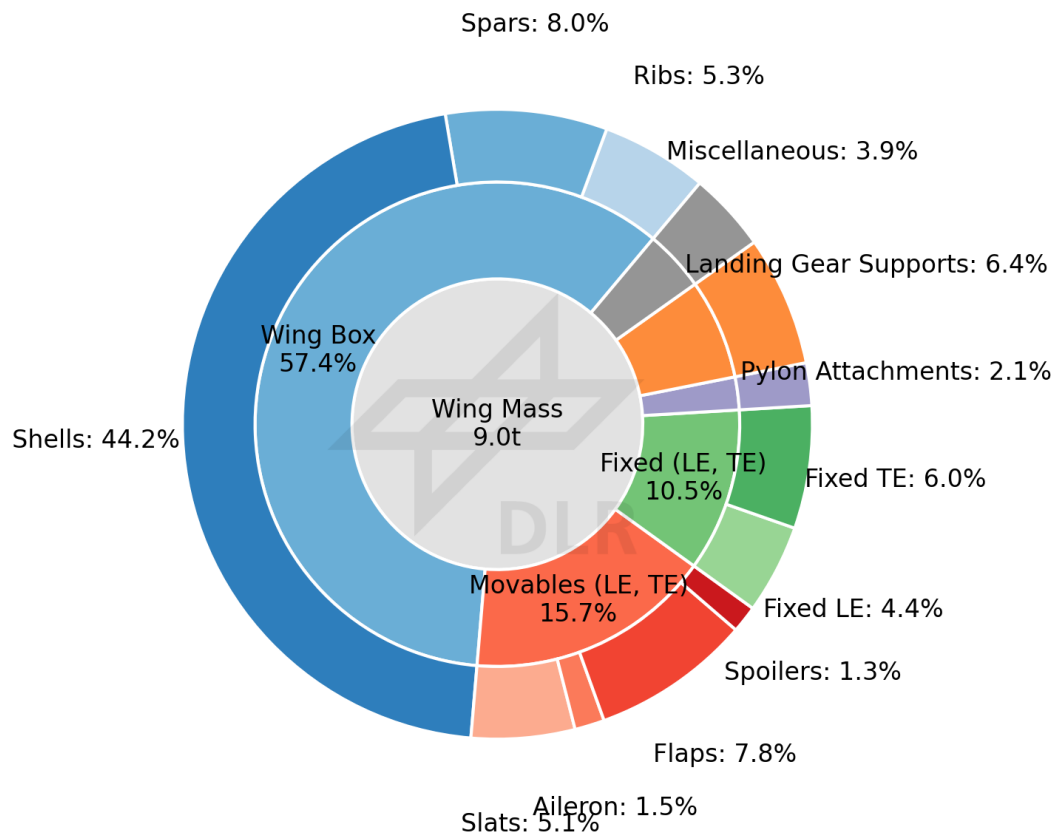


Mass Properties



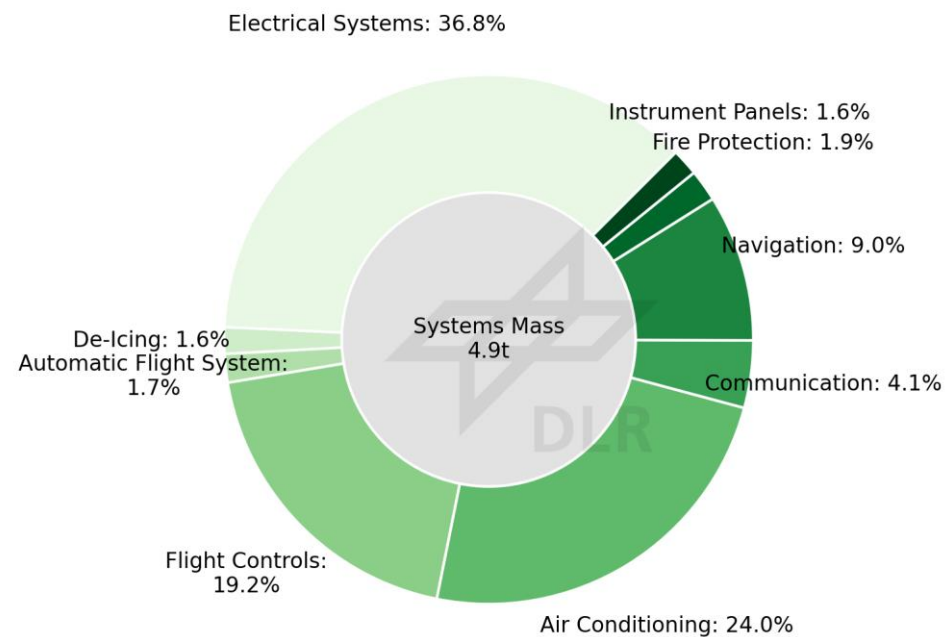
Component	Mass [kg]	x-Pos [m]
Wing	8971	24.91
Fuselage Structure	13994	24.47
HTP	624	49.17
VTP	684	46.88
Pylons	911	21.77
Power Units	6723	20.18
Main Gear	2714	25.2
Nose Gear	443	5.0
Systems	9681	25.68
Furnishings	3981	20.48
Manufacturer Empty Mass (MEM)	48730	-
Operator Items	6633	-
Operating Empty Mass (OEM)	55364	23.86
Maximum Payload	25000	20.48
Maximum Fuel	3557	43.12
Maximum Zero-Fuel Mass (MZFM)	80365	-
Maximum Landing Mass (MLM)	81491	-
Maximum Take-Off Mass (MTOM)	82655	23.71

Wing Mass Breakdown



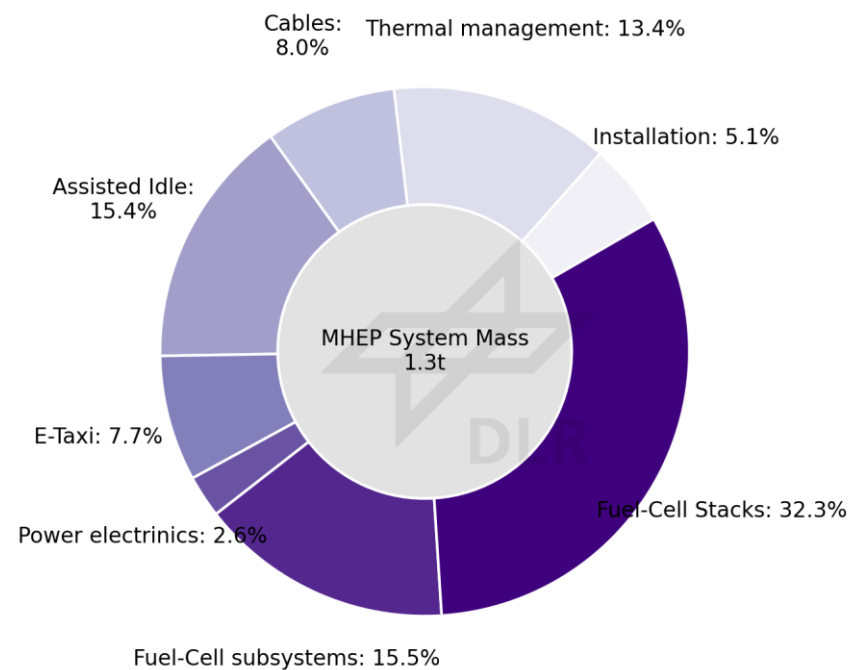
Component	Mass [kg]	Portion [%]
Wing Box	5149	57.4
Ribs	471	5.3
Shell	3963	44.2
Spars	715	8.0
Fixed Leading Edge	395	4.4
Fixed Trailing Edge	543	6.0
Movable Leading Edge	458	5.1
Slats	458	5.1
Movable Trailing Edge	955	10.6
Flaps	704	7.8
Aileron	132	1.5
Spoilers	119	1.3
Pylon Attachments	189	2.1
Landing Gear Support	575	6.4
Miscellaneous	351	3.9
Wing	8971	100.0

System Mass Breakdown



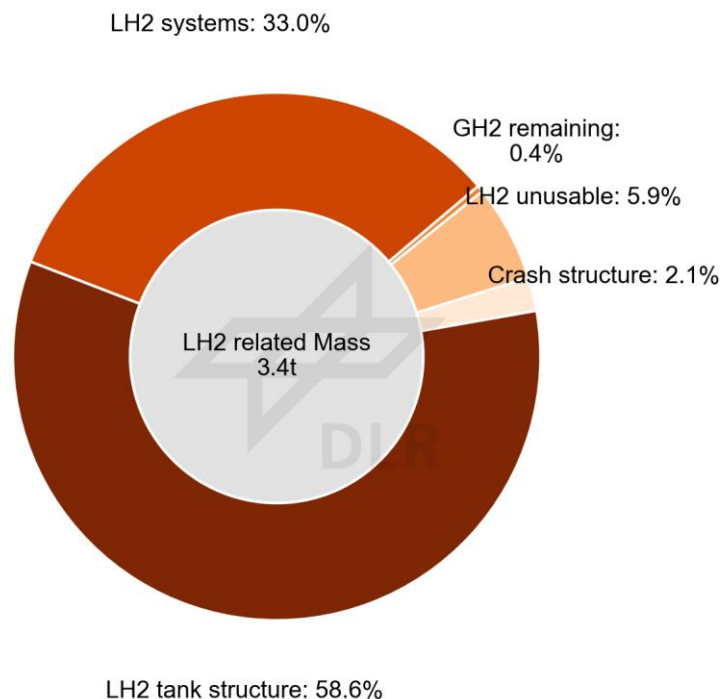
Component	Mass [kg]	Portion [%]
Air Conditioning	1184	12.2
Auxiliary Power Unit (APU)	0	0.0
Automatic Flight System	86	0.9
Communication System	203	2.1
De-Icing	80	0.8
Electrical System	1815	18.7
Flight Controls	950	9.8
Fire Protection	96	1.0
Hydraulic System	0	0.0
Instrument Panels	81	0.8
Navigation	443	4.6
Systems	9681	100.0

MHEP System Mass Breakdown

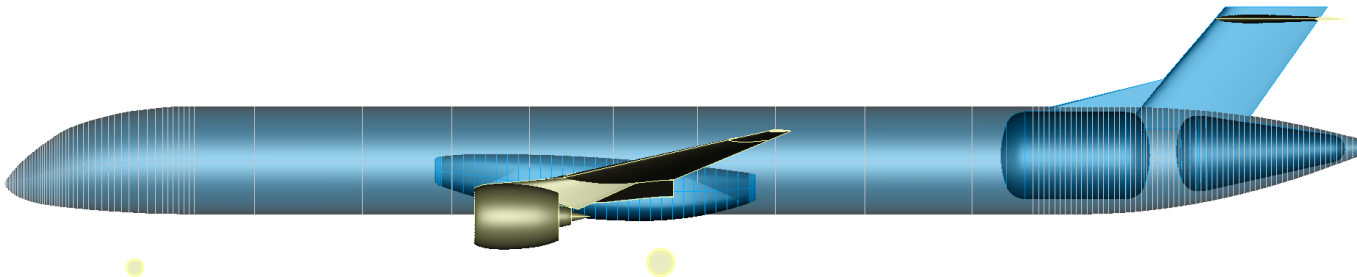


Component	Mass [kg]	Portion [%]
Installation	67	5.1
Thermal management	174	13.4
Cables	105	8.0
Assisted Idle	200	15.4
E-Taxi	100	7.7
Power electronics	34	2.6
Fuel-Cell subsystems	202	15.5
Fuel-Cell Stacks	421	32.3

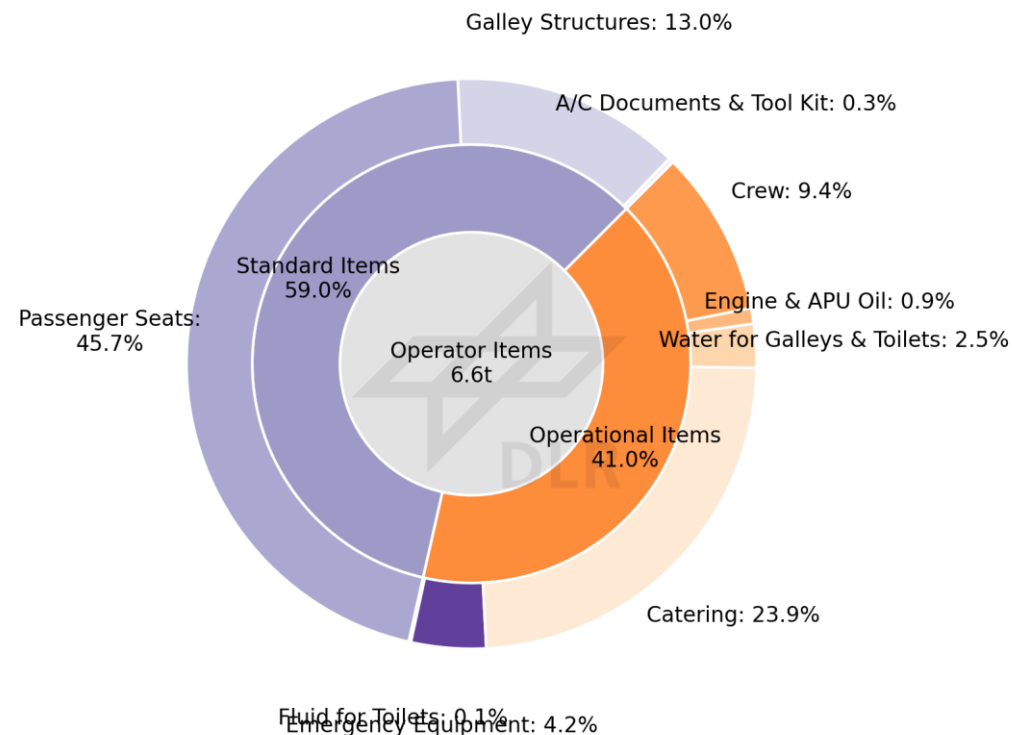
LH2 Tank and System Mass Breakdown



Component	Mass [kg]	Portion [%]
Crash structure	71	2.1
LH2 unusable	204	5.9
GH2 remaining	14	0.4
GH2 vented	0	0.0
LH2 systems	1134	33.0
LH2 tank structure	2016	58.6

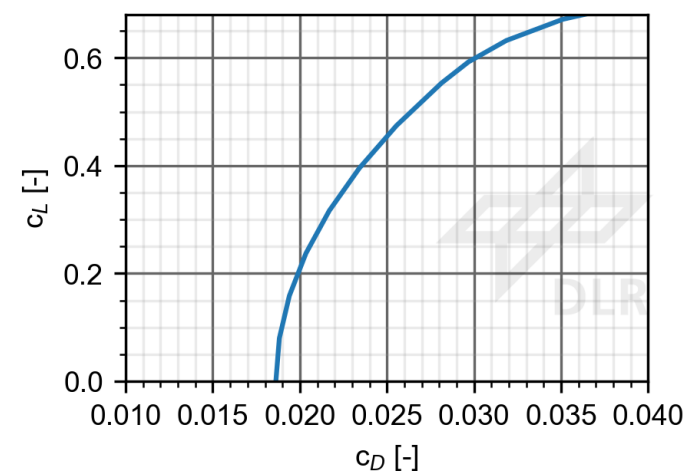


Operator Items Mass Breakdown

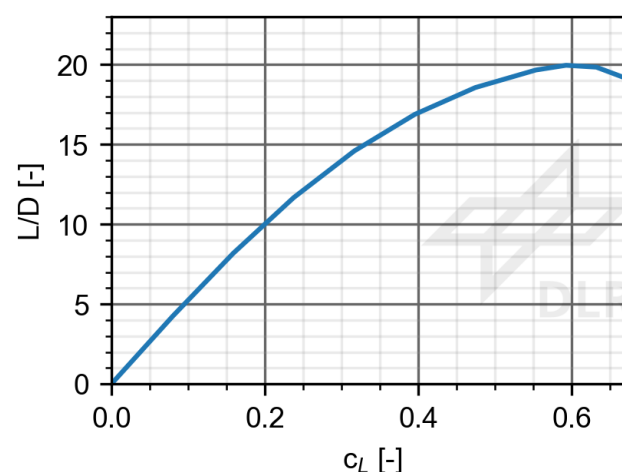


Component	Mass [kg]	Portion [%]
A/C Documents & Tool Kit	19	0.3
Galley Structures	861	13.0
Passenger Seats	3031	45.7
Fluid for Toilets	9	0.1
Emergency Equipment	281	4.2
Catering	1588	23.9
Water for Galleys and Toilets	165	2.5
Engine & APU Oil	59	0.9
Crew	621	9.4
Operator Items	6633	100.0

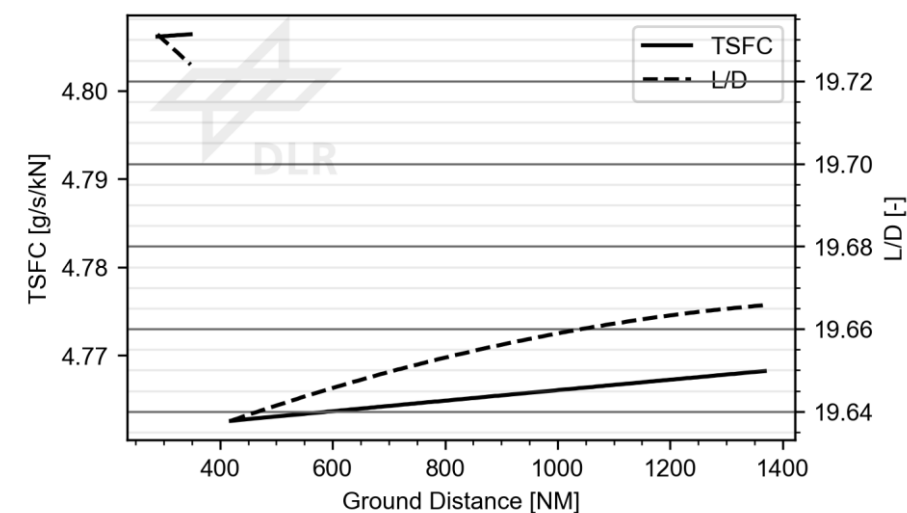
Aerodynamic Performance



— Clean: Ma=0.78, Flight Level=350



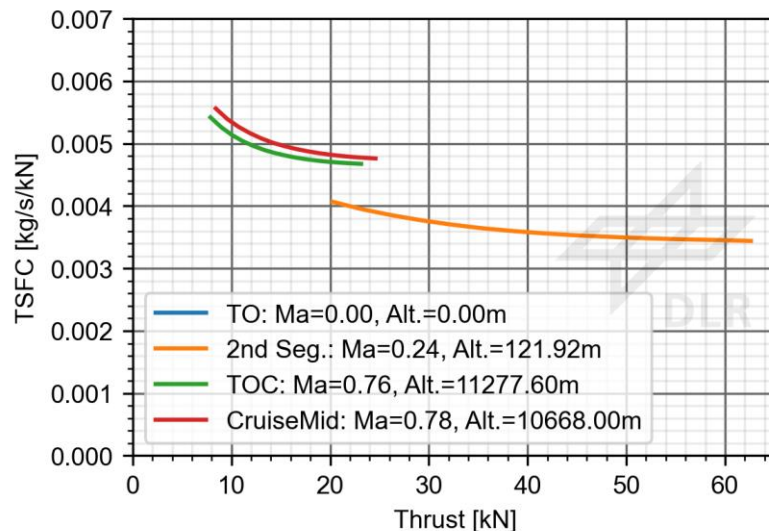
— Clean: Ma=0.78, Flight Level=350



Engine Performance Requirements



Parameter	Unit	Take-Off	EOF	2nd Seg.	TOC	Mid Cruise
Delta Temp. ISA	K	0	0	0	0	0
Mach-Number	-	0.0	0.237	0.237	0.76	0.78
Altitude	ft	0.0	35.0	400.0	35000	37000
Engine Rating	-	MTO	RTO	RTO	MCL	MCR
Thrust	N	124980	68382	72558	22834	20298
Shaft-Power Offtakes	kW	0.0	0.0	0.0	0.0	0.0
Bleed Air Offtakes	kg/s	0.0	0.0	0.0	0.0	0.0



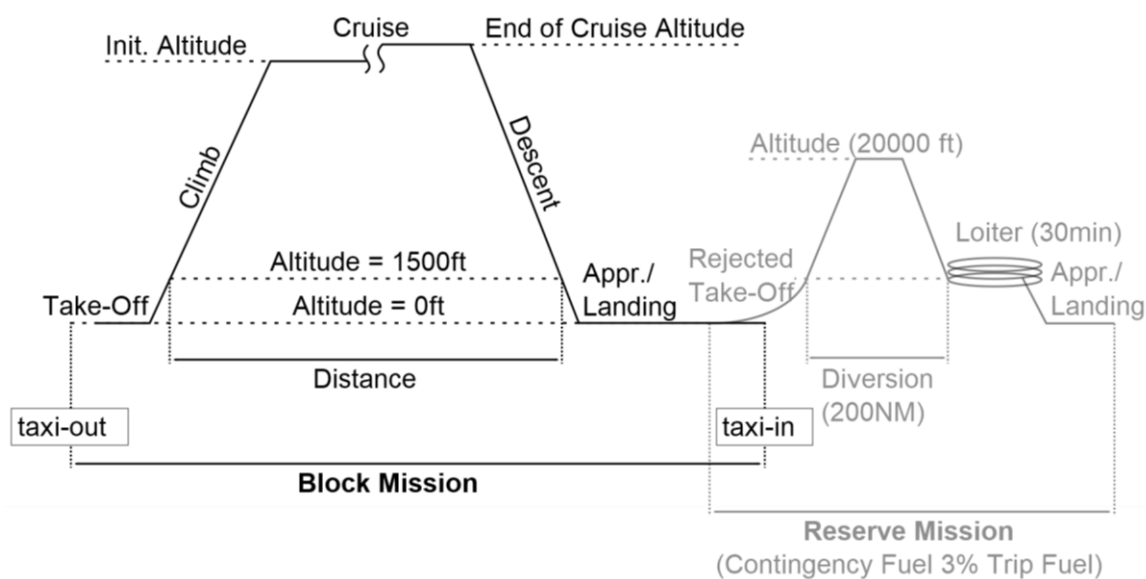
Description

- Take-Off:
 - at MTOM
- EoF (CS25.121a)
 - at approx. MTOM
 - Landing gear extended, Without ground effect
 - Critical engine inoperative
 - Gradient of Climb > 0%
- 2nd Segment (CS25.121b):
 - at approx. MTOM
 - Landing gear retracted , Without ground effect
 - Critical engine inoperative
 - at V2 Speed
 - Gradient of Climb > 2.4%
- TOC:
 - ROC ≥ 300 ft/min
- Cruise:
 - typically not a thrust sizing point but rather a efficiency related point

Mission Definition and Key Aircraft Characteristics



A design mission with a range of 1500NM and a number of passengers of 250PAX at 95 kg/PAX was defined according to D250-TF specification. For this design mission, all performance data are calibrated i.e. engine and aerodynamic performances

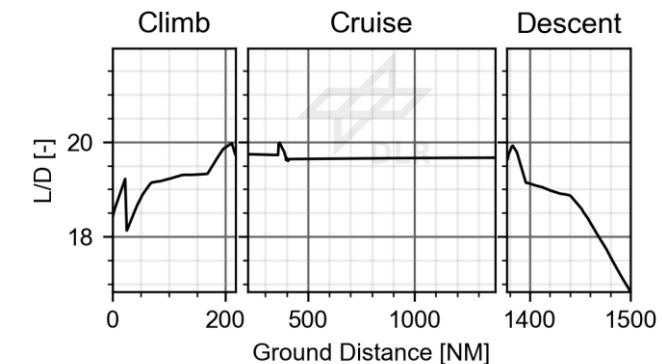
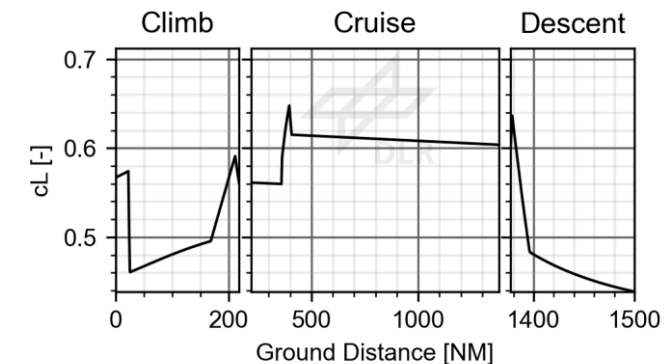
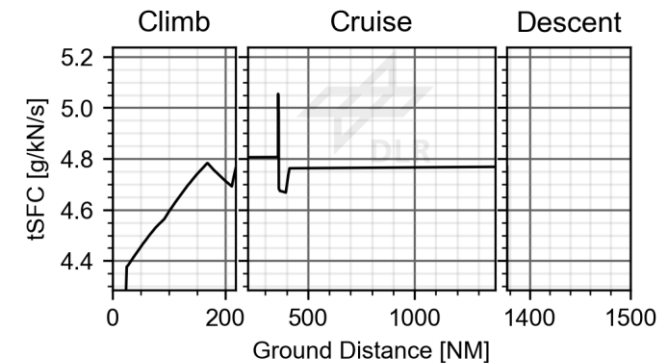
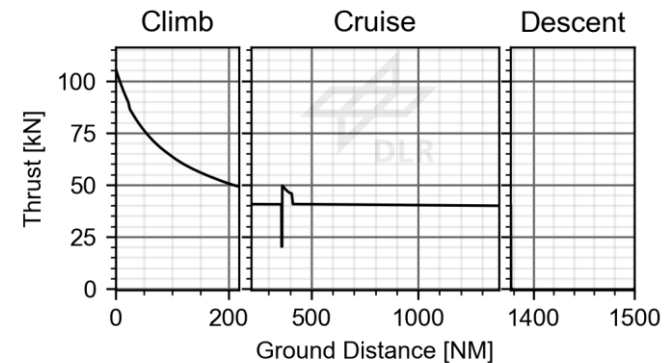
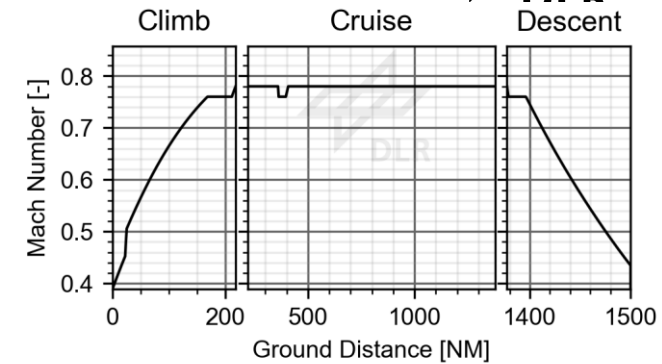
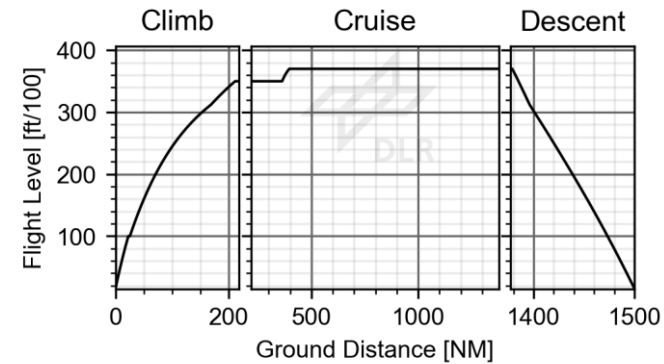


Parameter	Unit	Value
Design Range	NM	1500
Design Passenger Capacity	-	250
Design Cruise Mach Number	-	0.78
Max. Take-Off Mass	t	82.7
Max. Landing Mass	t	81.5
Max. Zero-Fuel Mass	t	80.4
Operating Empty Mass	t	55.4
Max. Fuel Mass	t	3.6
Max. Payload	t	25
Wing Area	m	141.0
Wing Span	m	42.0
Mean Aerodynamic Chord	m	4.1
Wing Loading (@MTOM)	kg/m ²	586.2
Thrust-to-Weight Ratio (@ISA)	-	0.308
Engine Type	-	Turbofan
Thrust (Sea Level Static, ISA)	kN	125.0

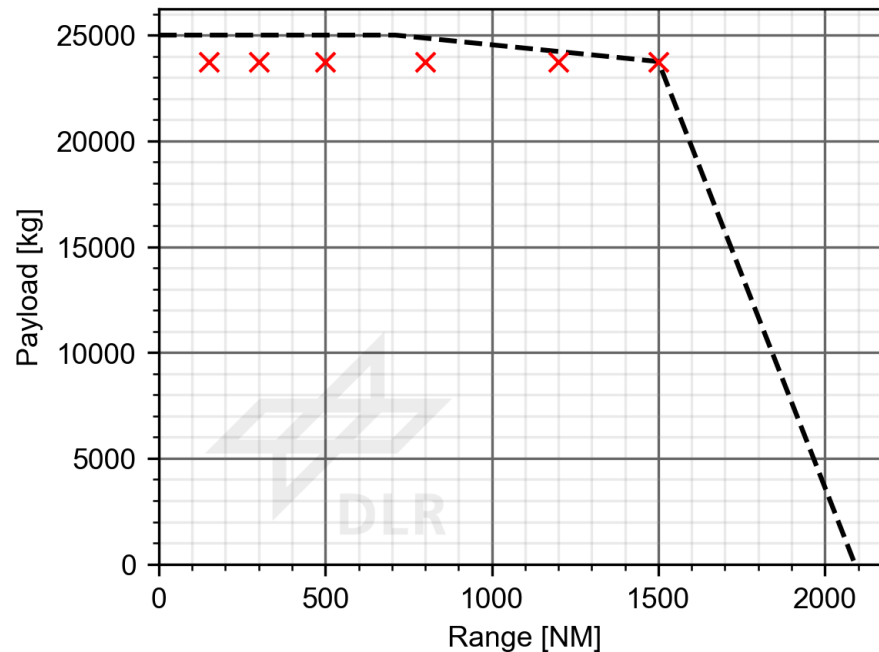
Design Mission Performance



Mission Phase	FLight Time [min]	Fuel Mass [kg]	Distance [NM]
Block Mission	229.9	2608.4	1500.0
Taxi-Out	9.0	16.8	0.0
Take-Off	2.0	77.3	0.0
Climb	34.2	631.5	217.8
Cruise	155.6	1806.4	1159.6
Descent	20.1	25.7	122.6
Approach & Landing	4.0	40.0	0.0
(Taxi-In)	5.0	10.7	0.0
Reserve Mission	87.5	1248.0	419.5
Go-Around	1.6	69.5	0.0
Diversion Climb	17.1	358.2	95.1
Diversion Cruise	4.0	46.4	26.4
Diversion Descent	31.2	307.0	182.0
Holding	30.0	349.7	116.0
Diversion Approach & Landing	3.6	39.8	0.0
Contingency	0.0	77.4	0.0



Payload-Range Characteristics



General Information:

- Max. Payload: 25000 kg
- Design No. PAX: 250 @ 95 per PAX
- Design Mission: 1500NM @ 23750 kg Payload

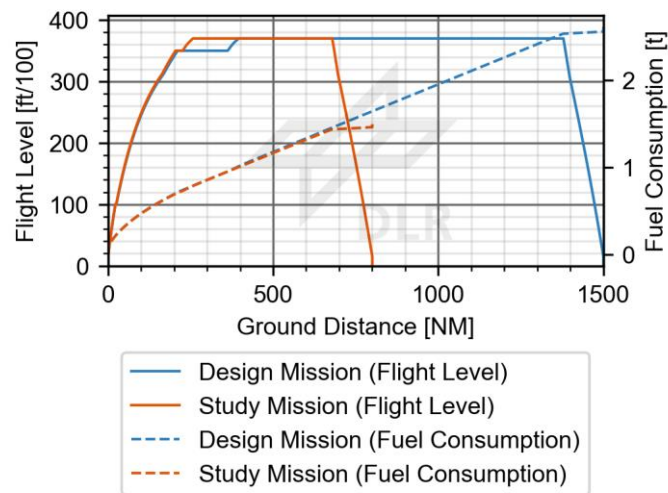
Mission Profile:

- Start/Arrival: Typical Long-Range Allowance
- Climb: 280kts
- Cruise: Mach 0.78
- Descent: 280kts

Reserve:

- No wind, ISA condition
- 200NM Alternate Airport
- 30min Holding @1500 ft
- Contingency Fuel: 3.0% Trip Fuel

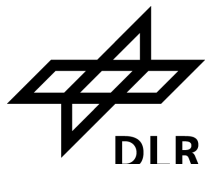
Cruise Performance Comparison



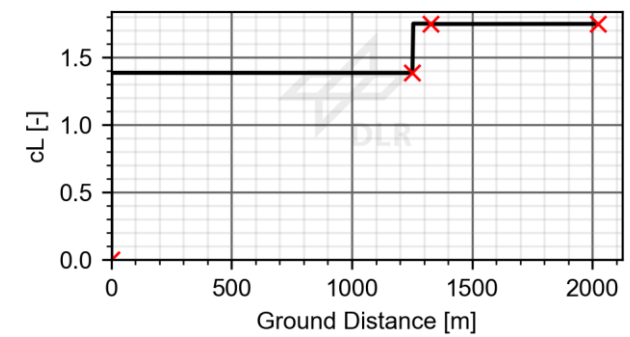
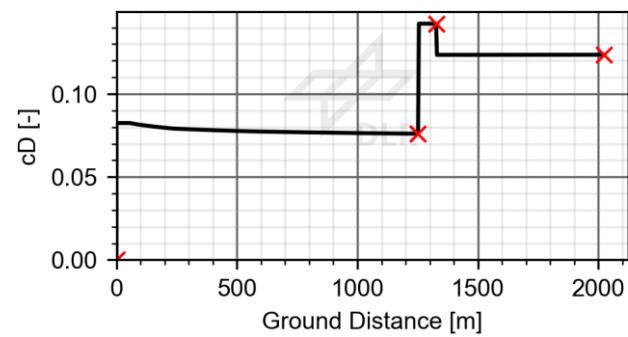
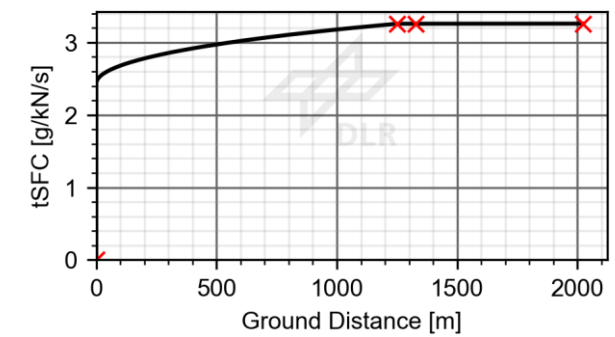
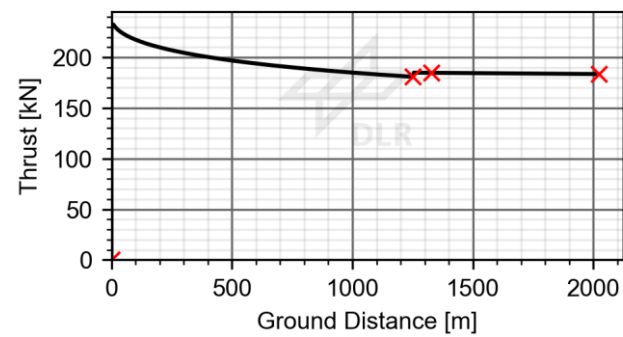
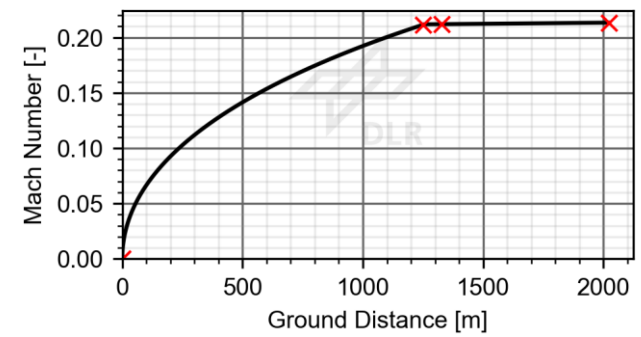
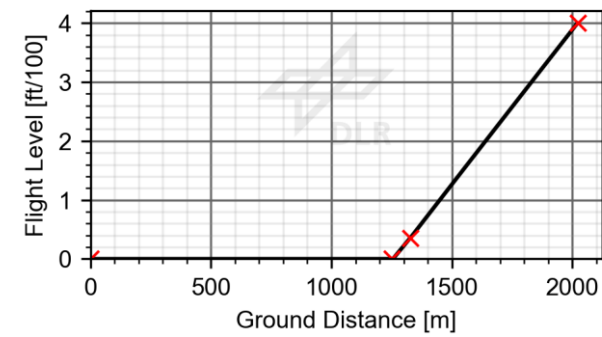
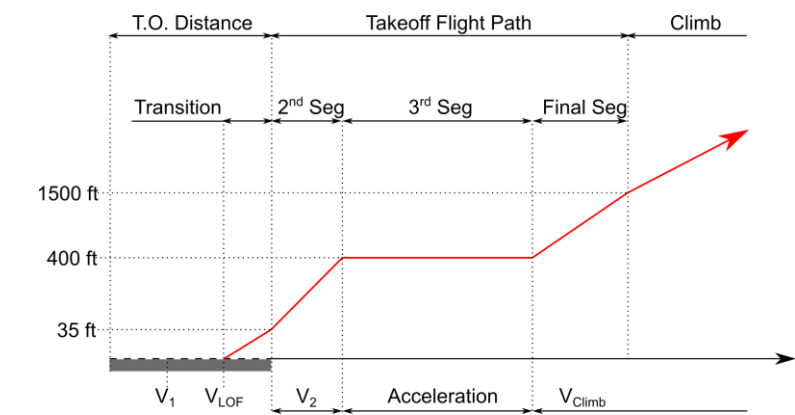
Parameter	Design Mission	Study Mission
Range [NM]	1500.0	800.0
Payload [t]	23.8	23.8
Mach Number (Cruise) [-]	0.78	0.76
Init. Cruise Altitude [FL]	350.0	350.0
Mid Cruise Altitude [FL]	370.0	361.0
End of Cruise Altitude [FL]	370.0	370.0
No. of Cruise Steps [-]	1.0	1.0

Parameter	Design Mission	Study Mission
Mid Cruise Performance		
Lift Coefficient [-]	0.613	0.613
Drag Coefficient [-]	0.031	0.031
L/D Ratio [-]	19.64	19.88
CAS [m/s]	129.9	128.9
TAS [m/s]	230.2	224.3
Angle of Attack [deg]	0.8	0.7
Thrust [kN]	40.6	47.9
Thrust max. [kN]	45.8	47.9
tsfc [g/kN/s]	4.76	4.67
Avg. Cruise Performance		
Lift Coefficient [-]	0.604	0.605
Drag Coefficient [-]	0.0307	0.0308
L/D Ratio [-]	19.67	19.64
CAS [m/s]	130.6	130.0
TAS [m/s]	230.1	229.7
Thrust [kN]	40.6	40.6
tsfc [g/kN/s]	4.77	4.76

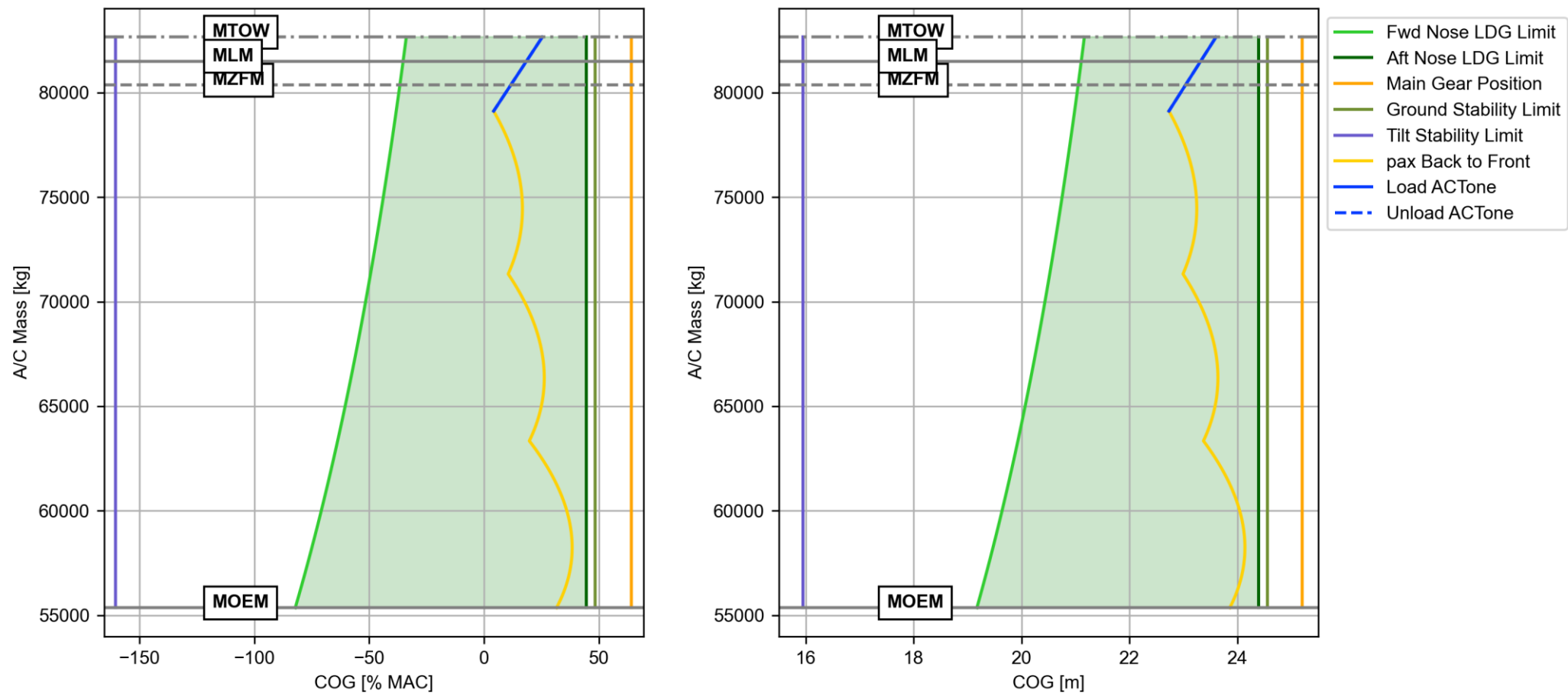
Take-Off Performance



Mission Segment	FLight Time [min]	Fuel Mass [kg]	Distance [NM]
Break Release	0.0	0.0	0.0
Take-Off GroundRoll	0.5	18.9	0.7
Transition Segment	0.0	0.6	0.0
2nd Segment	0.2	5.9	0.4



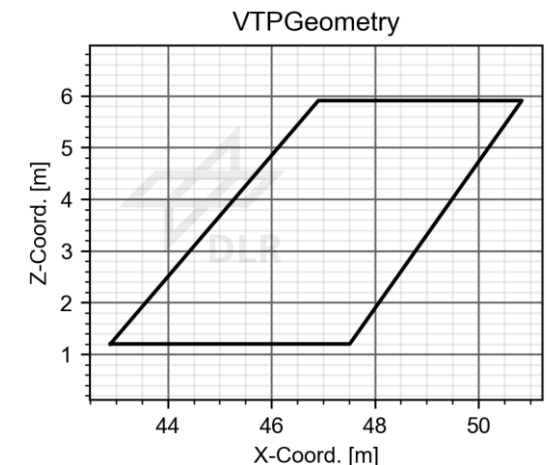
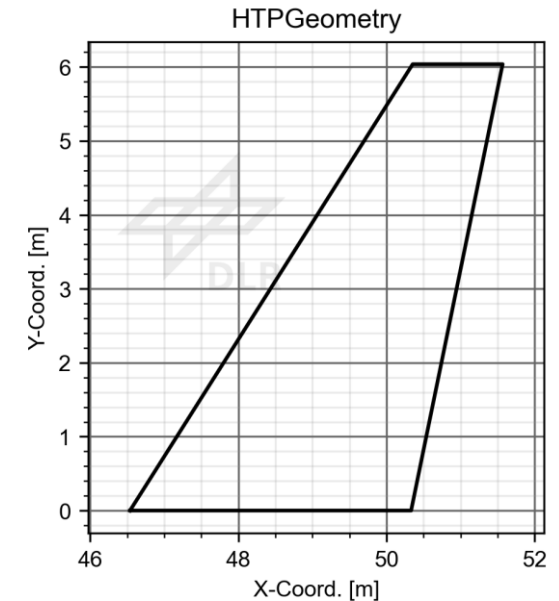
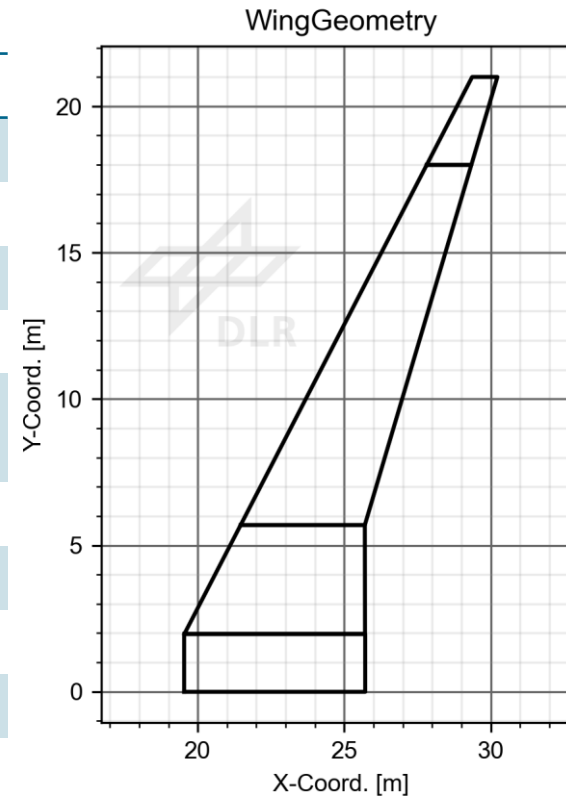
Weight & Balance



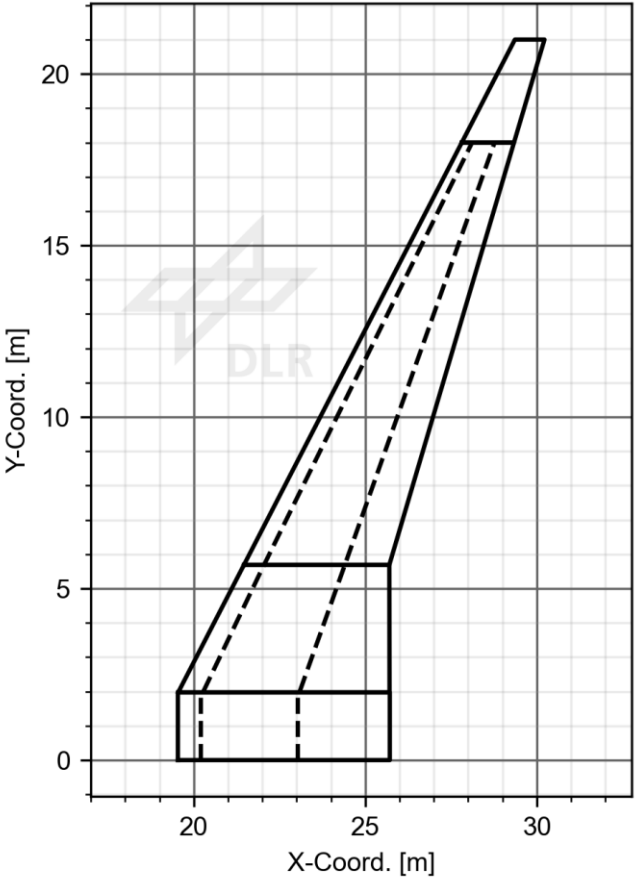
Lifting Surface Geometry Overview



Parameter	Unit	Wing	HTP	VTP
Reference Area	m ²	141.01	30.25	20.13
Span	m	42.00	12.07	4.71
Aspect Ratio	-	12.51	4.82	1.10
Taper Ratio	-	0.14	0.32	0.85
Mean Aerodynamic Chord	m	4.12	2.73	4.29
Avg. 1/4 Chord Sweep	deg	24.58	27.71	39.26
Avg. Dihedral	deg	8.06	0.00	-
Lever Arm	m	-	25.21	22.33
Volume Coefficient	-	-	1.3131	0.0759
Material	-	FILL	FILL	FILL

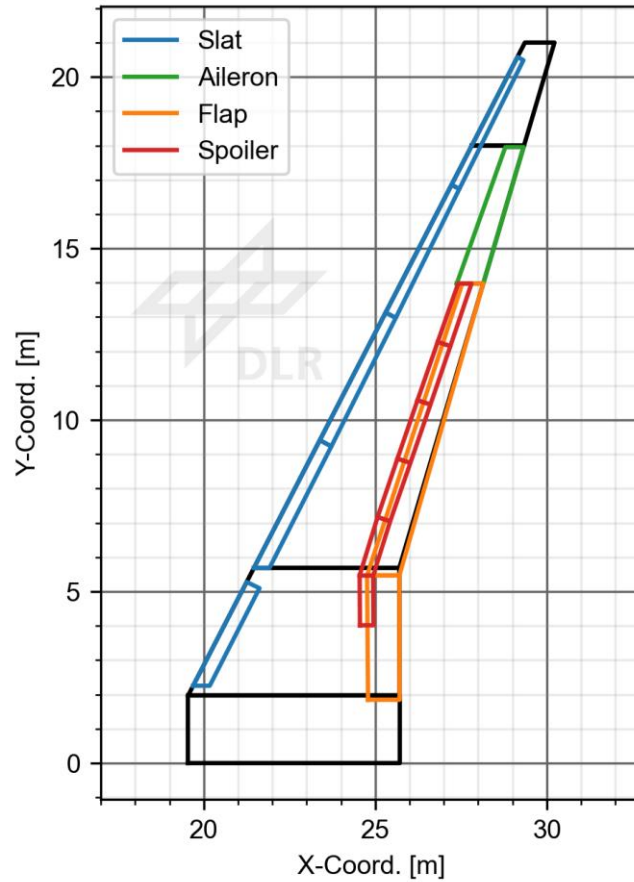


Wing Box Geometry Overview



Wing Section	Unit	Center	Root	Kink	Mid	Tip
Position	m	0.00	1.98	5.69	18.00	21.00
Rel. Position	%	0.00	9.40	27.10	85.70	100.00
Chord	m	6.16	6.16	4.24	1.52	0.86
1/4 Chord Sweep	deg	0.00	0.00	21.16	24.75	24.76
LE Sweep	deg	0.00	0.00	27.30	27.30	27.30
TE Sweep	deg	0.00	0.00	0.00	16.46	16.46
Dihedral	deg	0.00	0.00	10.00	7.00	7.00
Twist Angle	deg	2.80	2.80	1.10	1.00	0.00
Thickness Ratio	%	15.00	15.00	13.00	12.00	11.00
Rel. Spar Position						
Front Spar	%	10.70	10.70	13.58	19.70	27.00
Rear Spar	%	56.60	56.60	68.38	62.85	56.10

Wing Movable Arrangement Overview



Control Surface	y Inboard	y Outboard	Chord Inboard	Chord Outboard
Slat1	2.254	5.278	0.48	0.46
Slat1	5.69	9.412	0.45	0.42
Slat2	9.412	13.134	0.42	0.37
Slat3	13.134	16.856	0.37	0.29
Slat4	16.856	20.578	0.29	0.22
Aileron	13.978	17.953	0.77	0.53
Flap1	1.845	5.474	0.92	0.94
Flap1	5.467	13.978	0.94	0.61
Spoiler1	4.016	5.467	0.39	0.4
Spoiler1	5.467	7.169	0.4	0.41
Spoiler2	7.169	8.871	0.41	0.42
Spoiler3	8.871	10.574	0.42	0.42
Spoiler4	10.574	12.276	0.42	0.41
Spoiler5	12.276	13.978	0.41	0.39