

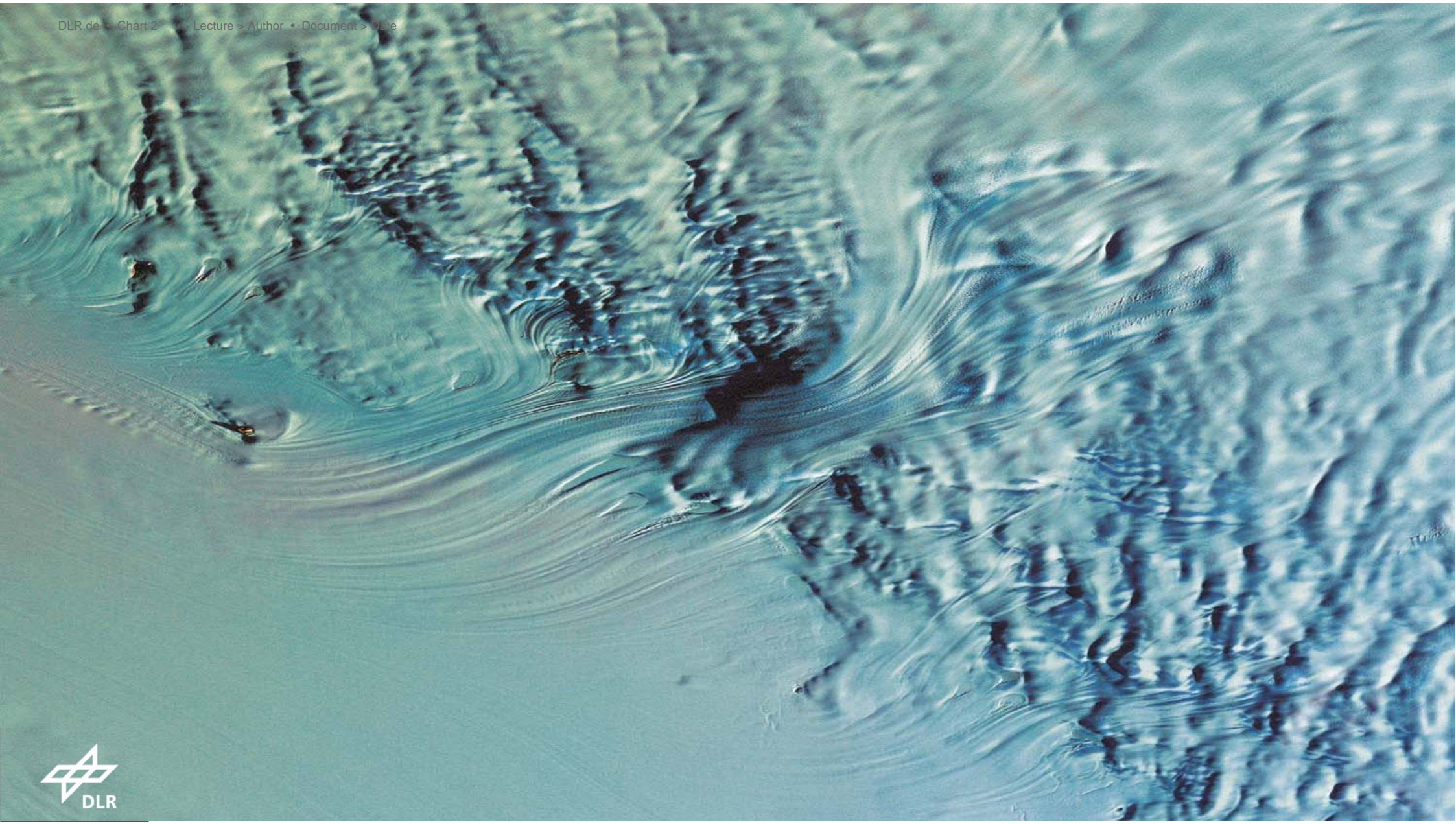
Human-In-The-Loop Echtzeitsimulation des SpaceLiner Passagierrettungskapselkonzepts

Frank Morlang



Knowledge for Tomorrow



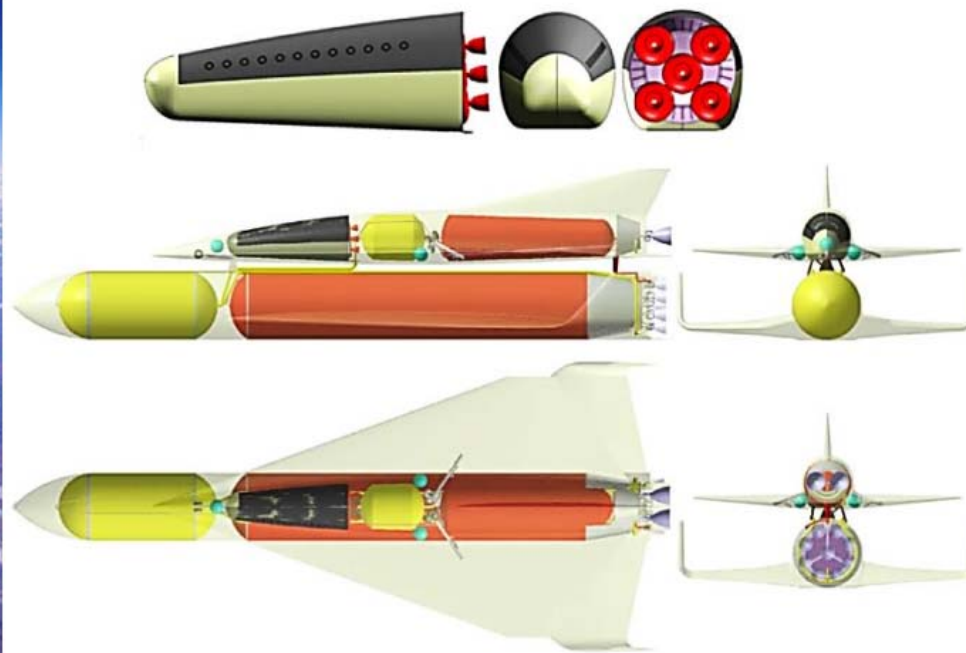


Überlick

- **SpaceLiner**
- **Rettungskapselkonzept HYPMOCES**
- **Simulationsansatz**
- **Umsetzung**
- **Erste Ergebnisse**
- **Ausblick**



SpaceLiner



Source:

Sippel, M., Bussler, L., Kopp, A., Krummen, S., Valluchi, C., Wilken, J., Prévereaud, Y., Vérant, J.-L., Laroche, E., Sourgen, F., Bonetti, D. 2017. Advanced Simulations of Reusable Hypersonic Rocket-Powered Stages. In: *21st AIAA International Space Planes and Hypersonic Systems and Technologies Conference*. AIAA 2017-2170.

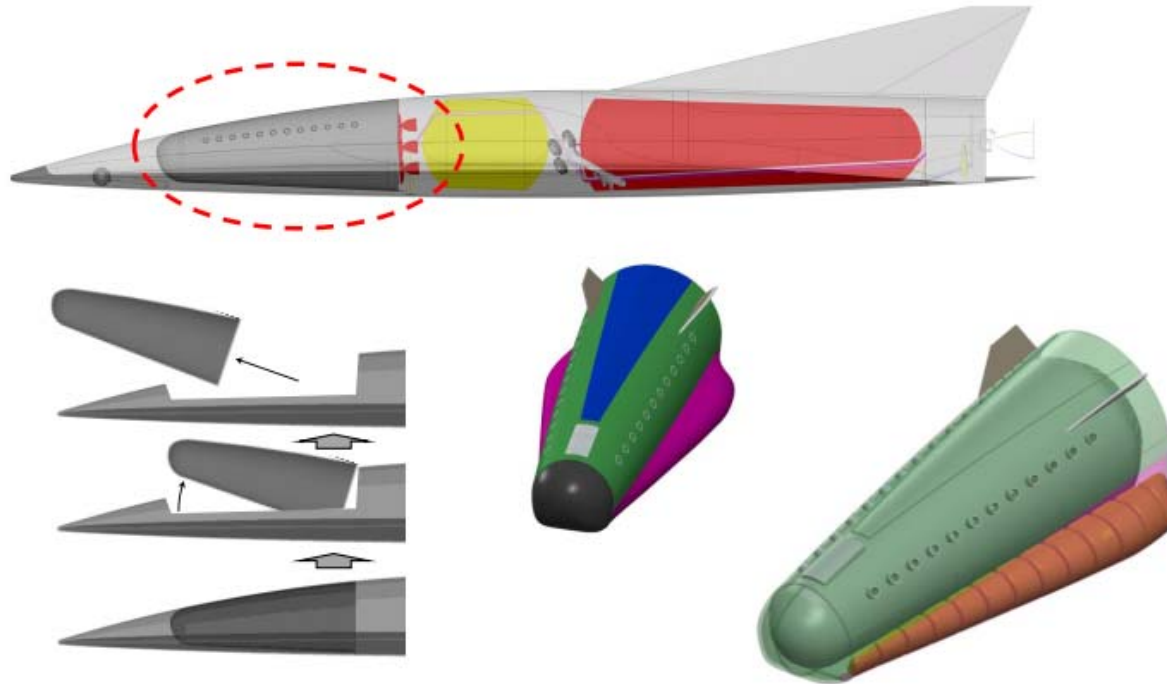


Rettungskapselkonzept HYPMOCES

Hypersonic Morphing for a Cabin Escape System



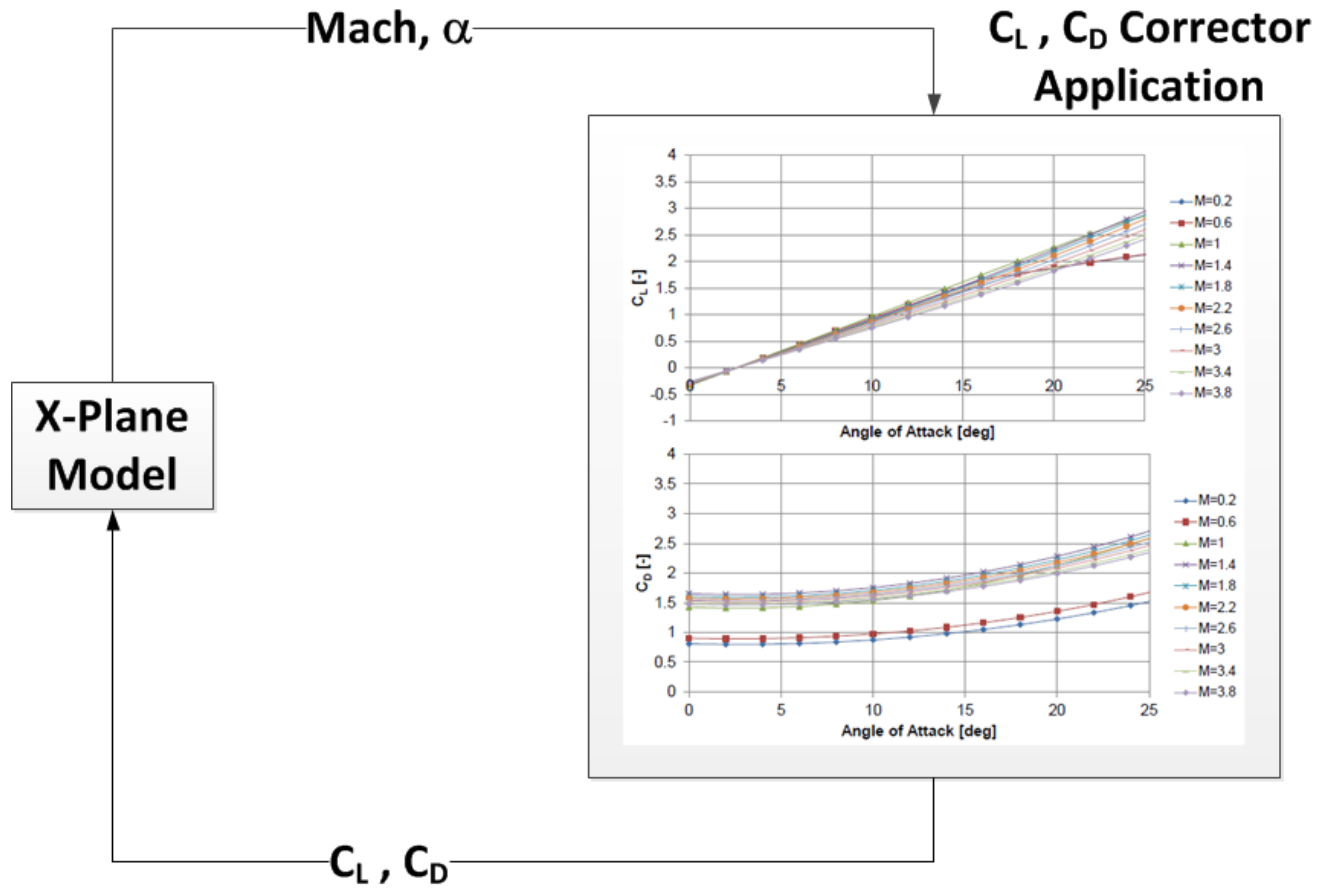
Rettungskapselkonzept HYPMOCES



Source: D. Bonetti, R.H. Ramos, C. Parigini, J.F. Mallol, M. Kerr, P. Rosa, T. Schwanekamp, M. Sippel, M. Johannson, F. Fossati, G. Gambacciani, F. Sourgen, E. Laroche, "Hyperonic Morphing for a Cabin Escape System", HYPMOCES, ATD8, ELECNOR DEIMOS, Lison, March 2015

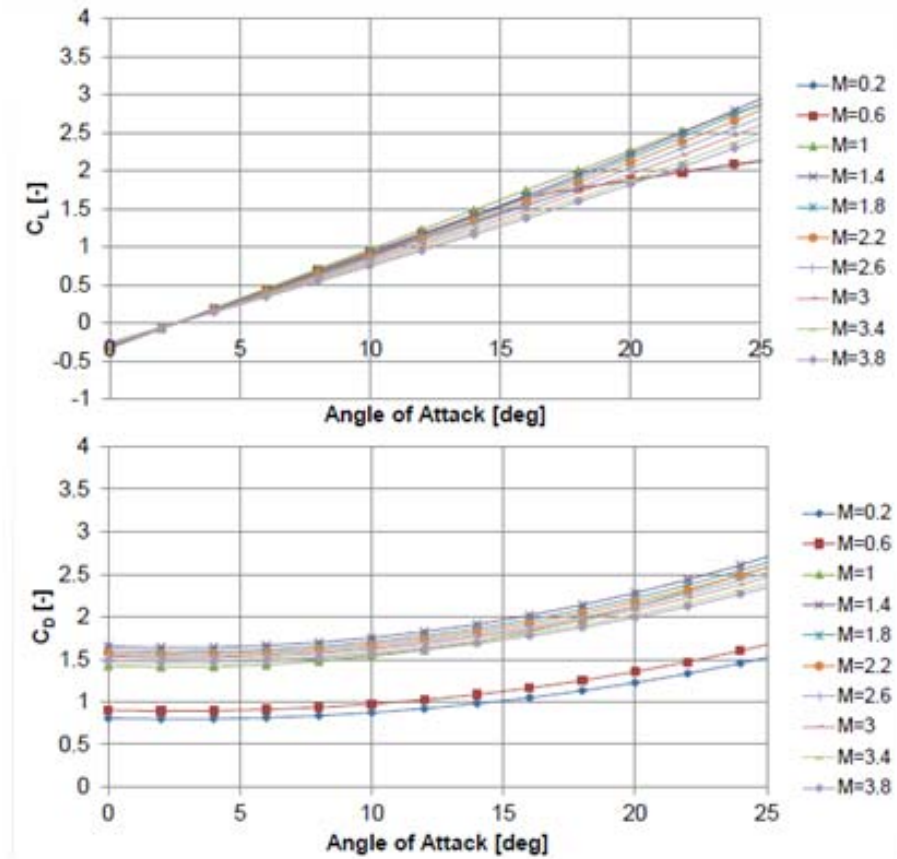


Simulationsansatz 1

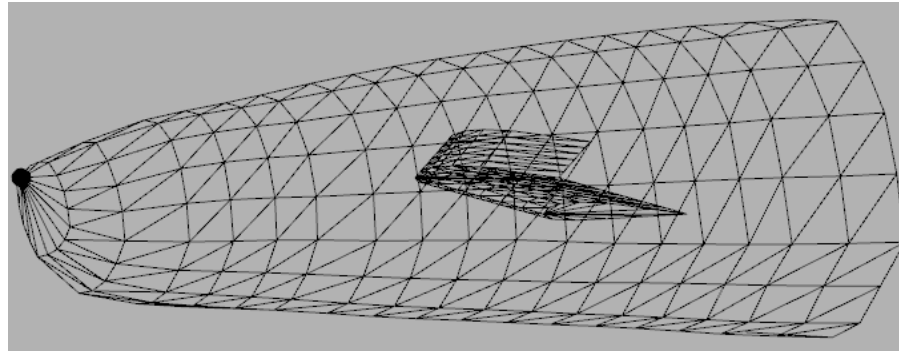
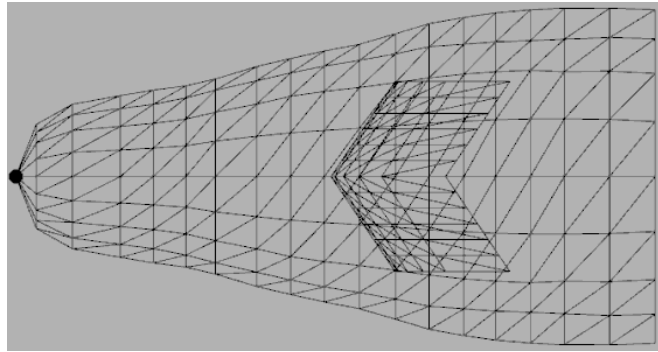
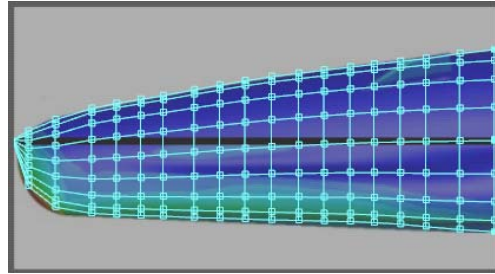
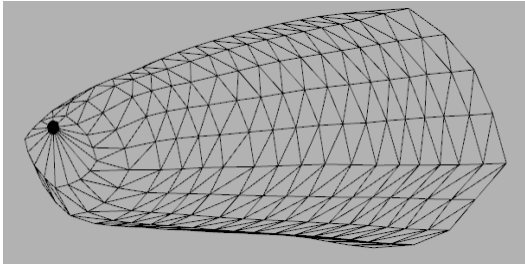


Simulationsansatz 2

X-Plane
Model



Umsetzung (Simulationsansatz 2)



Erste Ergebnisse (Fallschirmauslösung)

f-act	f-sim	frame	cpu	gpu	grnd	flit
59.98	60.01	0.017	0.016	0.011	1.000	1.000
/sec	/sec	time	time	time	ratio	ratio

real	totl	missn	timer	zulu	local	hobbs
376.7	269.8	269.8	0.000	11.62	13.62	0.883
time	time	time	time	time	time	time

Mach	WI	Gload	Gload	Gload
0.049	-3154	-0.000	-1.000	0.000
ratio	fpm	norml	axial	side

SLprs	SLtmp	wind	wind	trb	prec	hail
29.92	15.00	0.000	0.000	0.000	0.000	0.000
inHG	degC	speed	dir	locl	locl	locl

baro	edens	vacum	vacum	elec	elec	AHRS	AHRS
29.92	1.000	2.000	2.000	1.000	0.000	1.000	1.000
inHG	part	ratio	ratio	ratio	ratio	ratio	ratio

elev	ailrn	ruddr
0.004	0.004	0.004
yokel	yokel	yokel

trim	trim	trim	flap	flap	slat	sbrak	sbrak
0.004	0.004	0.004	0.000	0.000	0.000	0.008	0.008
elev	ailrn	ruddr	handl	postn	ratio	handl	postn

pitch	roll	hdng	hdng
-89.97	179.1	190.0	187.8
deg	deg	true	mag

alpha	beta	hpath	vpath	slip
-0.028	0.000	125.5	-89.65	5.310
deg	deg	deg	deg	deg

lat	lon	alt	alt	on	alt	lat	lon
53.20	7.028	11634	11632	1.000	11635	52.00	6.000
deg	deg	ftmsl	ftagl	runwy	ind	south	west

X	Y	Z	vX	vY	vZ	dist	dist
-31492	3429	-22388	0.079	-16.01	0.056	16636	2.738
m	m	m	m/s	m/s	m/s	ft	nm

empty	payld	fuel	jetti	curnt	maxim	cg
77966	1433	3527	0.000	82926	87887	0.000
lb	lb	totlb	lb	lb	lb	ftref

L/D	cl	cd	L/D
-0.000	-9.99x99	99x9	0.000
ratio	total	total	*etaP

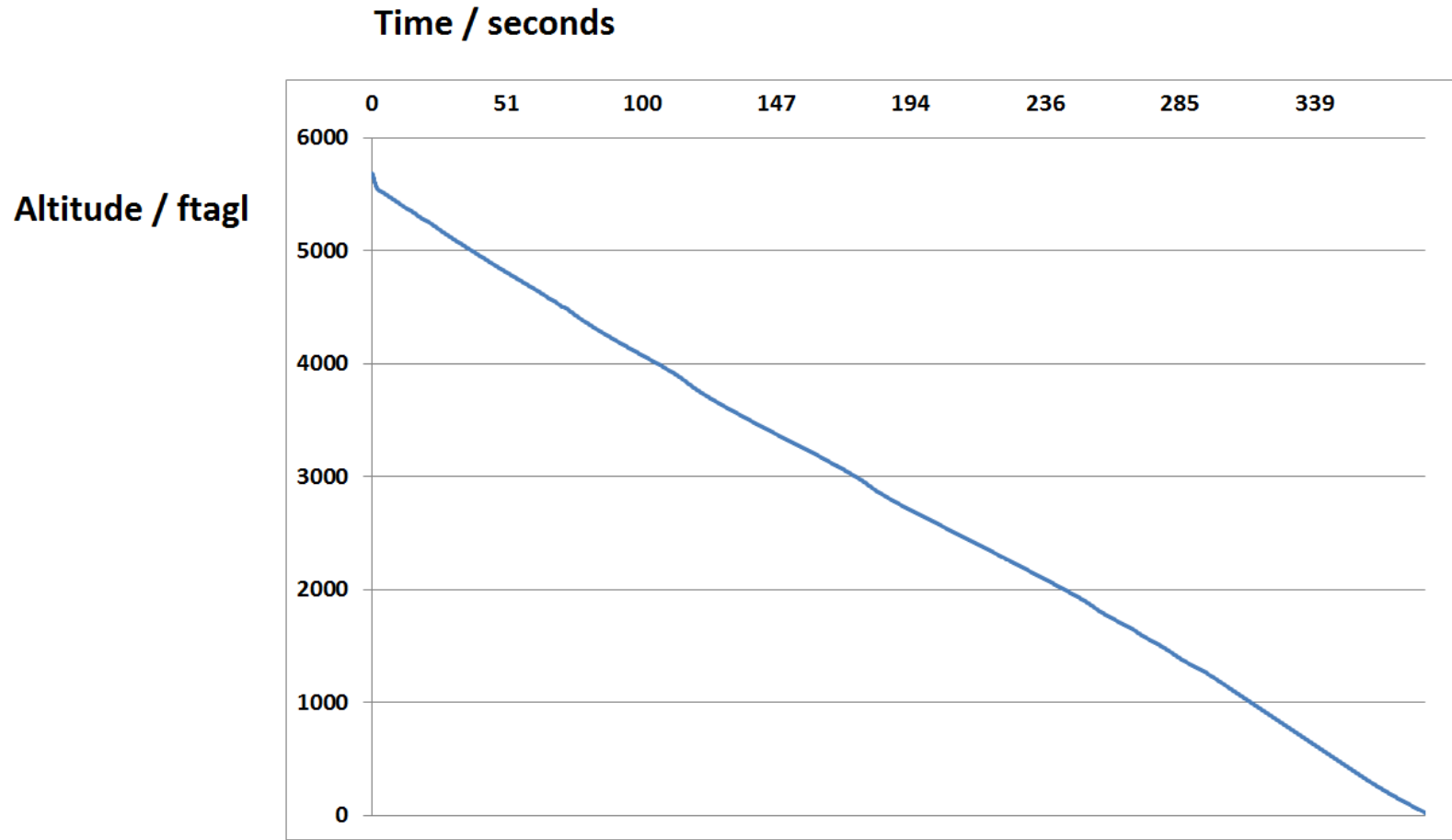


Erste Ergebnisse (Fallschirmauslösung)

3 Fallschirme je 5000 m² Fläche



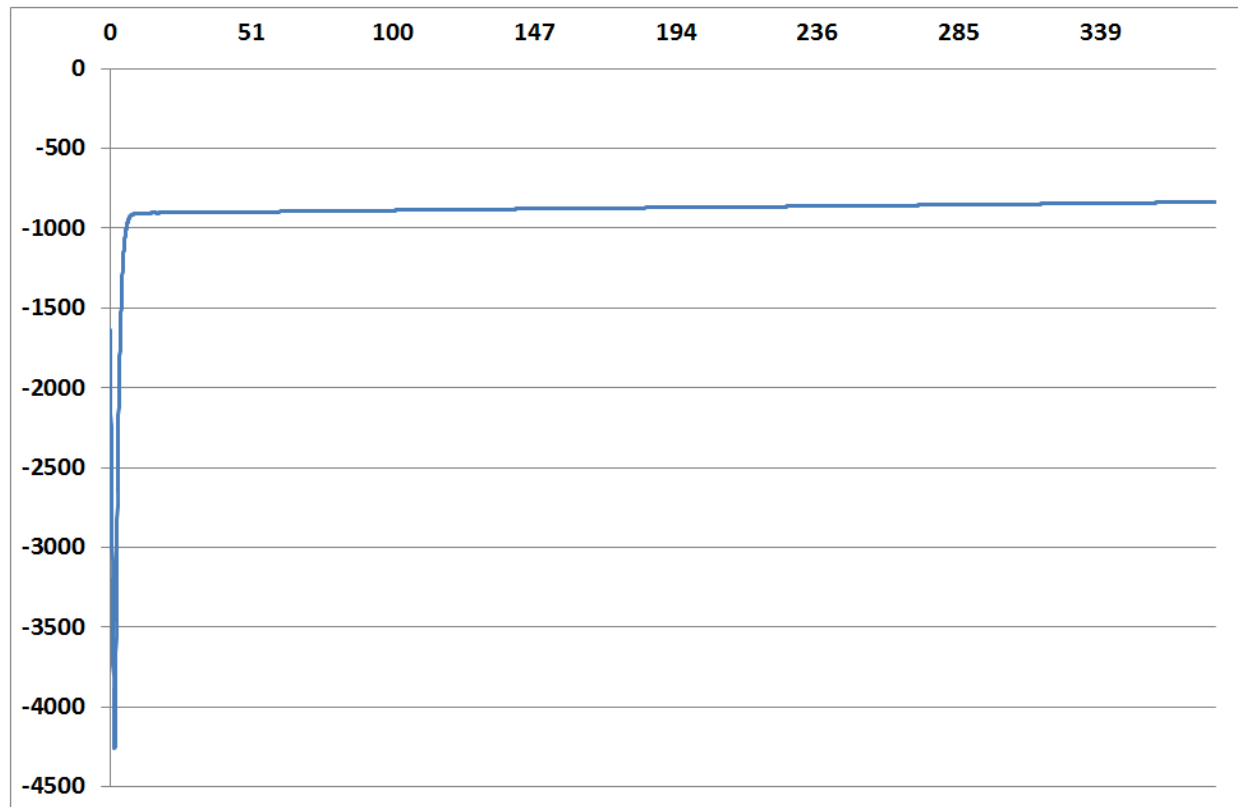
Höhe über Zeit



Sinkgeschwindigkeit über Zeit

Time / seconds

VVI / ftpm



Ausblick

- **Tuning der internen Flügel**
- **Realisation der Klappen**

