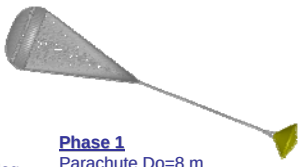
New EDLS architecture for small Mars Landers

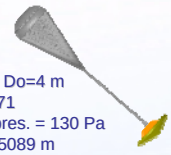
In order to verify the feasibility of near future exploration missions to Mars, such as Network Science, that are part of the enabling roadmap for subsequent manned missions on the red planet, a preliminary study has been carried out, aimed to define the optimal entry descent and landing system architecture.
Key driver for this study has been the maximum simplification of the entry, descent and landing systems, that means essentially limited GNC and avionics complexity, for a maximum entry mass target of 600 kg.

Entry Phase (t_0)
Probe mass: 600 kg
Probe diameter: 2,4 m
Entry velocity: 5700 m/s
Flight Path Angle: 12,5 ÷ 13,5 deg

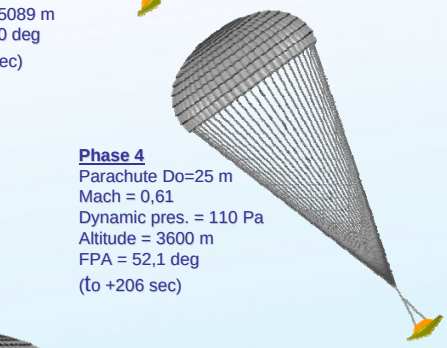


Phase 1
Parachute Do=8 m
Mach = 1,80
Dynamic pres. = 704 Pa
Altitude = 7015 m
FPA = 25,1 deg
(t_0 +176 sec)

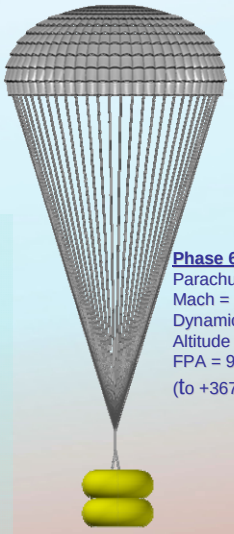
Phase 2
Parachute Do=8 m
Mach = 0,71
Dynamic pres. = 129 Pa
Altitude = 5201 m
FPA = 36,8 deg
(t_0 +191 sec)

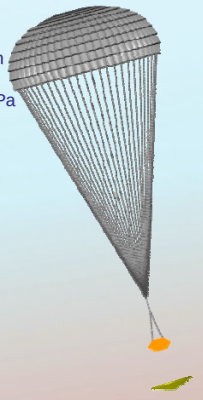


Phase 3
Parachute Do=4 m
Mach = 0,71
Dynamic pres. = 130 Pa
Altitude = 5089 m
FPA = 38,0 deg
(t_0 +192 sec)



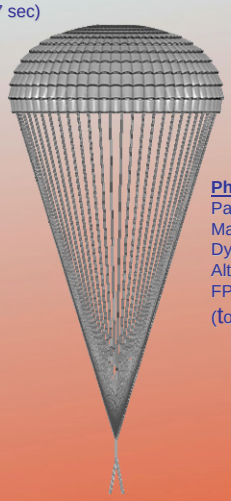
Phase 4
Parachute Do=25 m
Mach = 0,61
Dynamic pres. = 110 Pa
Altitude = 3600 m
FPA = 52,1 deg
(t_0 +206 sec)



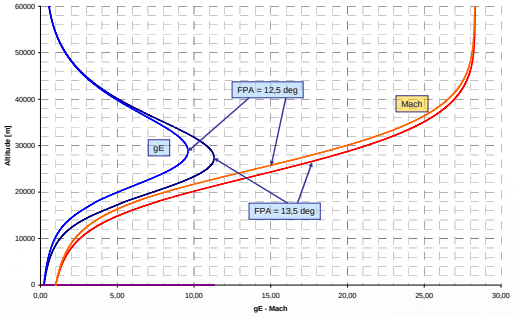


Phase 5
Parachute Do=25 m
Mach = 0,1
Dynamic pres. = 4 Pa
Altitude = 3040 m
FPA = 82,2 deg
(t_0 +221 sec)

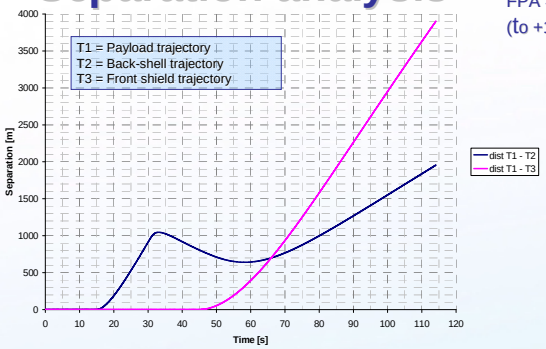
Phase 6
Parachute Do=25 m
Mach = 0,08
Dynamic pres. = 2 Pa
Altitude = 180 m
FPA = 90,0 deg
(t_0 +367 sec)



Phase 7
Parachute Do=25 m
Mach = 0,08
Dynamic pres. = 2 Pa
Altitude = 10 m
FPA = 90,0 deg
(t_0 +376 sec)

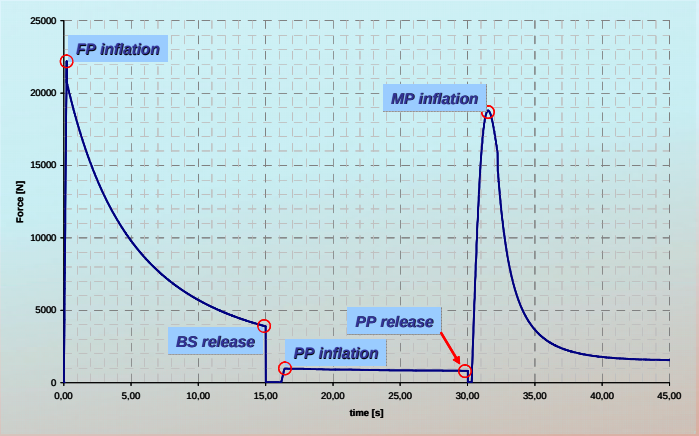


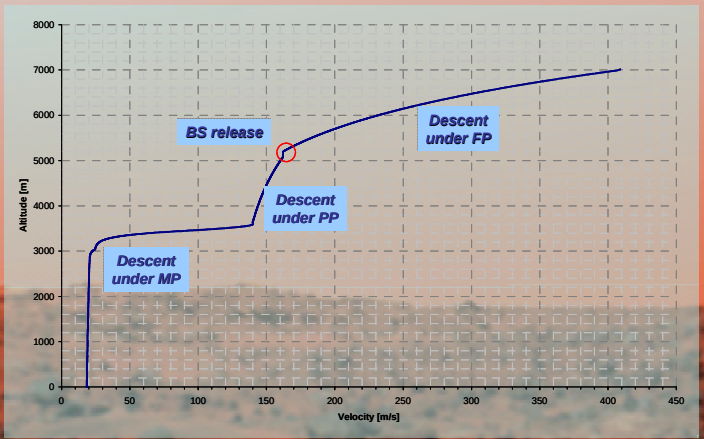
Separation analysis



Mission timeline

- First Parachute (*Disk Gap Band; Do=8m*) mortar deployment
2) Back-shell separation
3) Front shield and lander stabilization with pilot chute (*Disk Gap Band; Do=4m*) deployed by first chute
4) Main Parachute (*Ringsail; Do=25 m*) deployed by pilot chute
5) Front shield separation
6) Non vented airbag inflation
7) Lander release





Entry altitude referenced to equatorial radius
All other altitude referenced to ground level

AERO SEKUR