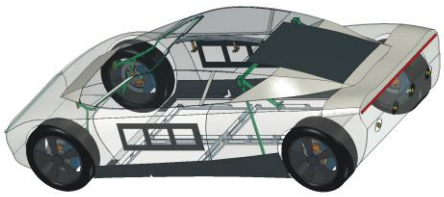
C.400 P.2 Flight and Roadster Rocket Comparison

R6E5 full fuel and landing reserve using the LLTV workflow

With 500 kg of fuel, both modelled R6E5 assemblies cover 4.51 km in 6 min 55 s airborne. They retain about 65 kg at rest with a 50 kg usable reserve requirement. The Roadster R5/C6I air budget gives a 2.98 s upper estimate with a 10% reserve.



C.400 P.2 · R6E5



Roadster · R07

Three records for comparison

Record	Interpretation
Historical C.400 P.2 flight	Published first free-flight duration of 255 s. Phase-level telemetry remains open.
C.400 P.2 flight simulations	Full-fuel P1 mission and short P0 reference run for 4100 and 5250 mm diagonals.
Roadster Rocket	Tesla footage gives duration bounds on the clip clock. Local R07 CAD and DEV25 runs retain their own conditions.

AAMS, p. 22 · Musée de l'Air et de l'Espace

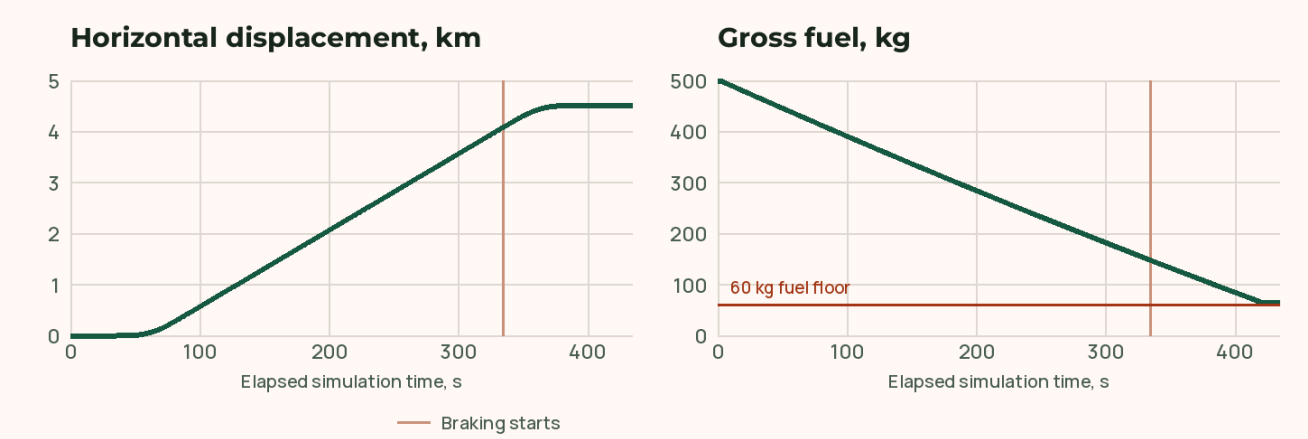
TextToCAD · local engineering release · 22 November 2026

texttocad.org · texttocad@gmail.com

Full-fuel flight P1

In still air the model climbs to about 5 m clearance, accelerates to 54 km/h, brakes and lands vertically. Airborne time runs from the last wheel leaving the surface to first contact.

Quantity	4100 mm	5250 mm
Airborne time, s	415.03	415.03
Displacement at rest, km	4.511	4.511
Fuel at start of braking, kg	147.94	147.94
Fuel at start of descent, kg	87.61	87.61
Fuel used from braking to rest, kg	82.87	82.87
Gross fuel at rest, kg	65.06	65.07
Usable fuel at rest, kg	55.06	55.07



The 4100 mm run is shown. The 5250 mm result coincides at chart scale.

Reserve and sensitivity

Both assemblies use the same 2,600 kg starting mass and aerodynamic model. Fuel flow scales from the R6E1 Atar cycle point. Nominal P1 uses 10 m² CdA and a 1.35 fuel-flow multiplier.

The 60 kg fuel floor includes 50 kg of usable reserve and 10 kg treated as unusable. Raising the fuel-flow multiplier from 1.35 to 1.50 and CdA from 10 to 14 m² gives 3.88 km and 6 min 13 s airborne. Achievable range depends on fuel flow and the drag-centre lever arm.

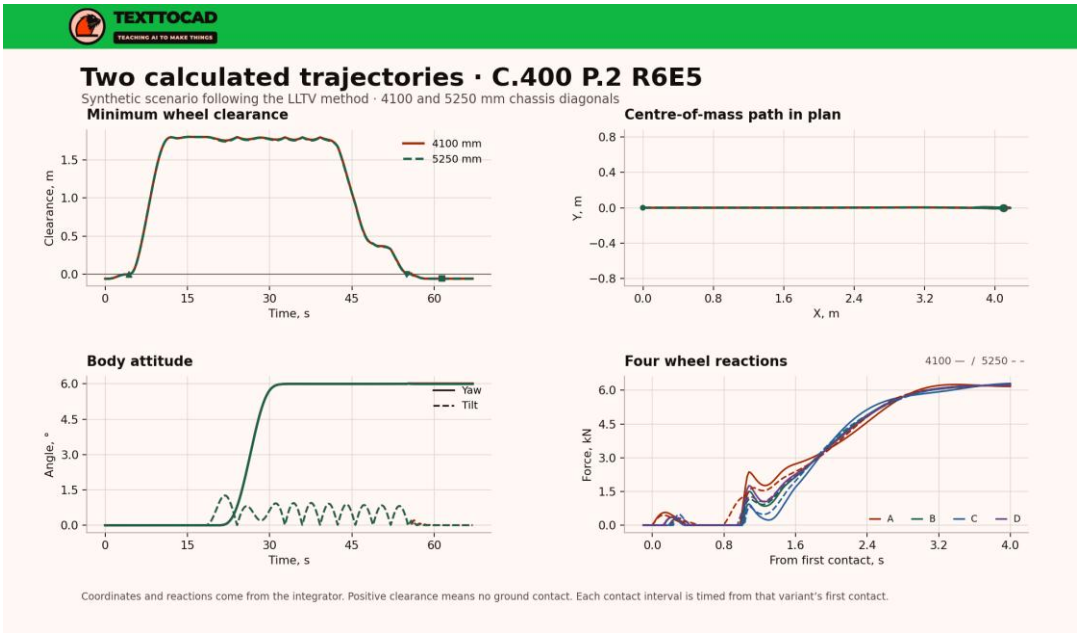
The animation covers 434 s of simulation time. The MP4 shows both assemblies together at 10× speed.

Player for both assemblies · MP4 · Assumptions · NASA Glenn · Drag Equation

P0 flight phases and pad contact

Times are measured from scenario start. The height metric is the clearance below the lowest unloaded support point above the pad plane. Flight events are derived from model states.

Quantity	4100 mm	5250 mm
Liftoff, s	4.272	4.272
First touchdown, s	54.961	54.908
Liftoff to contact, s	50.690	50.636
Settled support, s	61.440	61.385
Peak support clearance, m	1.801	1.801
Final horizontal displacement, m	4.102	4.093
Downward CG speed at contact, m/s	0.077	0.080
Fuel used over the full scenario, kg	45.58	45.53
Whole-run peak support reaction / weight	1.000	1.000
Scenario status	PASS	PASS



R6E5 scenario trace. Events and support reactions use the exported time series.

PASS applies to the numerical criteria for this scenario. Peak support reaction and stroke include the initial static state.

LLTV · NASA SP-2004-4535

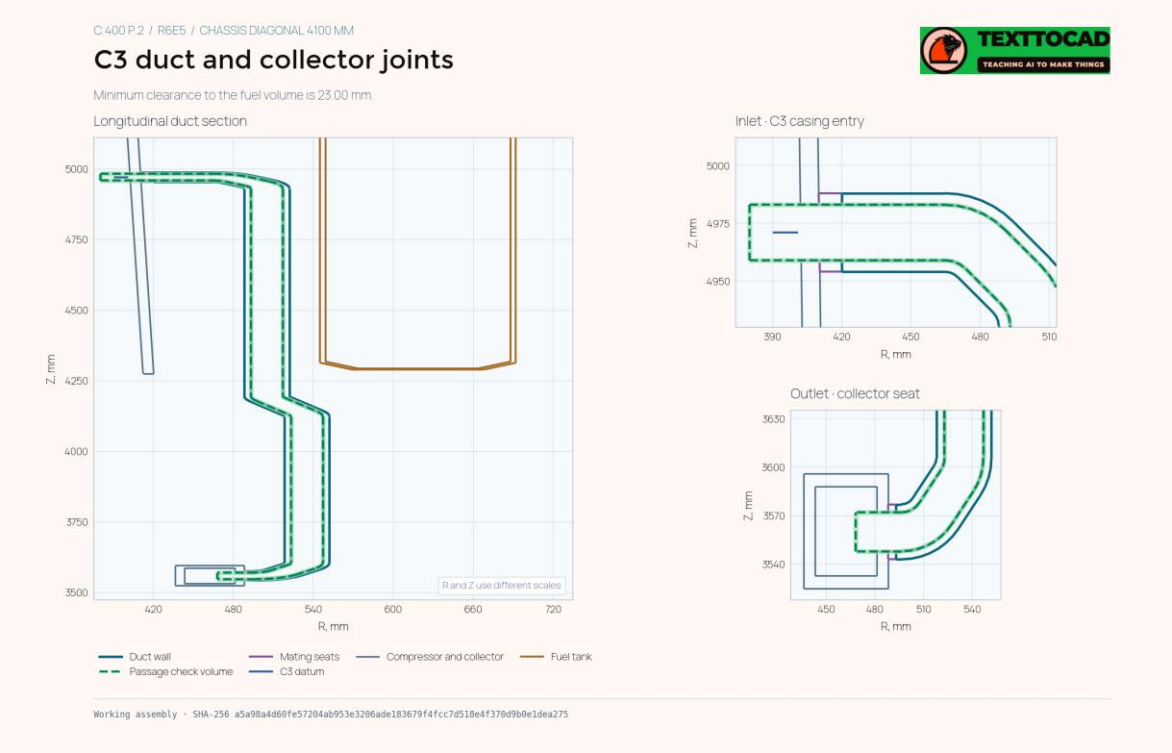
Flight model assumptions

The LLTV workflow informs the sequence of balance, control, liftoff, station keeping and landing checks. The table gives the R6E5 inputs and scenario assumptions.

Input	Adopted value and scope
Mission profile	Vertical liftoff, climb to 1.8 m, a hold, 4 m of translation and 6° of yaw. The thrust command ramps down over 3 s after contact.
Mass and balance	Initial mass 2,600 kg. Dry structure 2,000 kg, pilot 100 kg, fuel 500 kg. Initial CG is 4.397 m above the nominal tyre plane. Inertia is estimated. Fuel use changes mass, CG and inertia.
Engine and control	Atar 101 D.V. reference thrust cap 28.439 kN. Bleed derating up to 0.5%. Model limits are 200 N lateral and 65 N per active paired nozzle. Idealised state feedback updates every 20 ms.
Supports and tyres	Four R6E5 low tyre points. Flat pad and unilateral contact. Each support has 106.2 kN/m stiffness, 9.14 kN·s/m damping, up to 180 mm of travel. Friction coefficient 0.25. The touchdown feeler is excluded from load-bearing support.
Environment	Calm air. The model omits aerodynamic forces, ground effect, hot-gas reingestion, pad unevenness and fuel sloshing.
Historical record	The first free flight on 14 May 1957 lasted 255 s. References give 2,600 and 2,640 kg. Flight telemetry and actuator measurements are outside the scenario inputs.

R6E5 geometry reference

R6E5 geometry includes the C3 passage to the collector. Static BRep checks establish 452.389 mm² passage area and 23 mm clearance to the reserved fuel volume. Flow, losses, actuator response and hot-gas behaviour remain open.



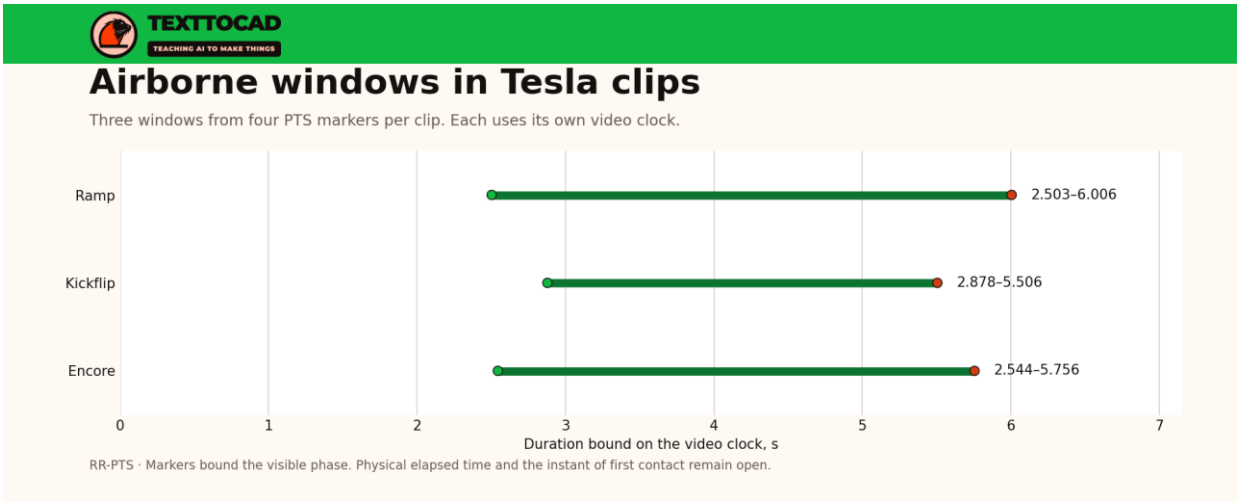
Section through the C3 passage and fuel envelope in the 4100 mm assembly. The package includes both sections.

AAMS, pp. 21–22 and 36 · C.400 P.2 museum record

Roadster Rocket motion phases

The comparison uses release, the visible airborne phase and the return to support. Ramp includes contact with the ramp before release. Presentation timestamps bound elapsed duration on the playback clock. Range and fuel budget for a Roadster mission comparable with P1 remain open.

Clip	PTS duration bounds, s	Observation limit
Ramp	2.503–6.006	Ramp contact is part of entry.
Kickflip	2.878–5.506	The instant of first contact is obscured.
Encore	2.544–5.756	The instant of first contact is obscured.



Inherited Tesla clip annotations. Intervals use the recording clock.

Local DEV25 trial series

The 5 m campaign accepted 0 of 4 cases. In a separate 2 m case, the CG rose 2.268 m and first contact occurred at 1.770 s. The simulation ended 29.5 ms after contact. Post-contact settling remains open.

Vehicle architecture

Phase	C.400 P.2 R6E5	Roadster Rocket
Release	Atar thrust unloads all four supports.	Ramp shows separation after travel along the ramp.
Airborne phase	The simulation holds altitude with thrust and varies body attitude.	Clips show the path and attitude. The available sources provide no telemetry.
Landing	The solver tracks first contact, support reactions and settling as thrust falls.	Clip annotations bound what is visible. DEV25 has its own contact model.

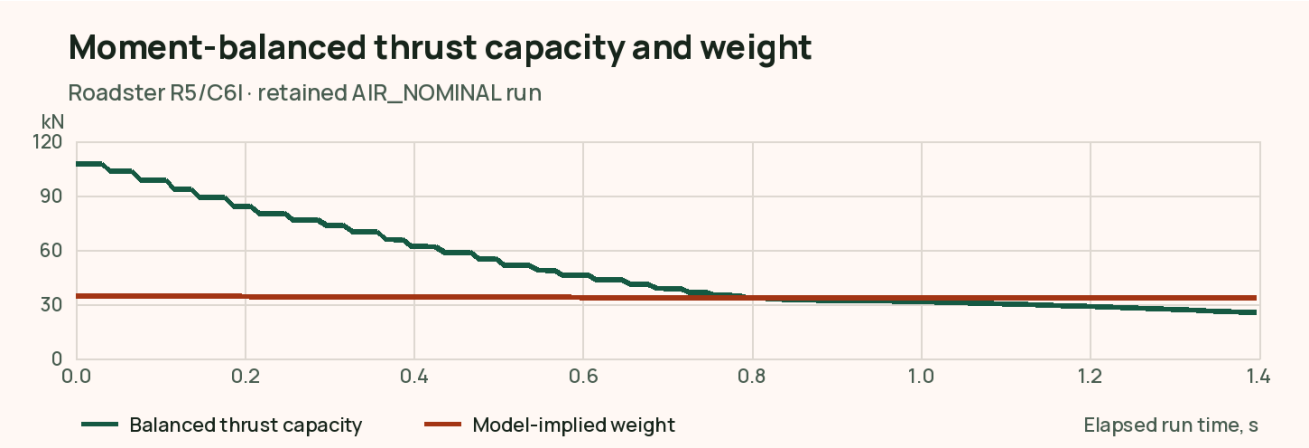
Ramp · Kickflip · Encore · Tesla Q3 2026

Roadster full charge and landing reserve

The local R5/C6I model uses 235.27 kg of dry air across the system and 3312 kg without gas. The 10% reserve floor is 23.53 kg. The P1 profile exceeds the impulse budget. The screen allows 54 km/h at release and equal vertical velocities at release and contact.

Scenario	Airborne time	Displacement	Fluid at rest
R6E5 P1 4100	415.03 s	4.511 km	65.06 kg kerosene
R6E5 P1 5250	415.03 s	4.511 km	65.07 kg kerosene
Roadster R5/C6I	≤2.98 s	≤44.7 m airborne	Unknown

R6E5 displacement runs to settled rest. The Roadster value is an upper impulse estimate for the airborne leg.



AIR_NOMINAL trace. After the curves cross, moment-balanced thrust capacity is below weight.

Gas inventory and landing authority

The trace retains 1.33 s after release and 1.05 m to the last sample. The model stops with 134.68 kg of air. Last-sample moment-balanced thrust capacity is 25.52 kN against 33.80 kN weight. The record ends before contact and rest.

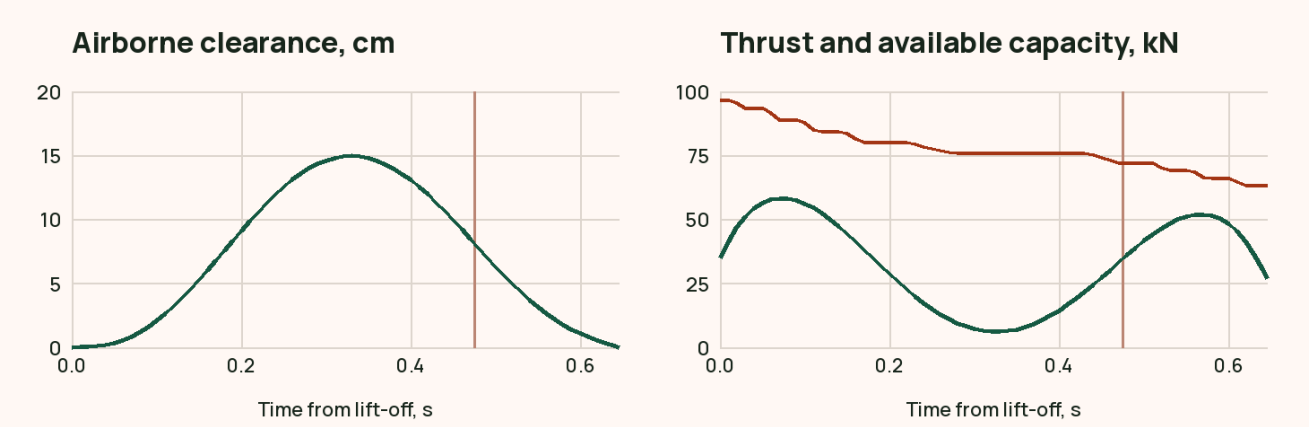
The budget uses 475 m/s effective exhaust speed from the trace. An ideal energy screen gives 4.82 s and 72.3 m. Both screens omit drag, airborne acceleration and flow limits.

Calculation and assumptions · Tesla Roadster · NASA Glenn

Roadster short flight RR H1

Both model cases reach soft touchdown and rest with over 10% reserve. The car enters at 18 km/h from a ground roll. The descent flare starts at 8.1 cm clearance. Initial air is 235.27 kg and the reserve floor is 23.53 kg.

Quantity	Nominal	Adverse
Airborne, s	0.645	0.645
Peak clearance, cm	14.9	14.9
Displacement to touchdown, m	3.22	3.22
Downward touchdown speed, m/s	0.23	0.23
Displacement to rest, m	9.53	9.54
Air at touchdown, kg	185.34	173.68
Air at rest, kg	183.97	171.00
Minimum thrust margin, kN	14.36	0.97



Nominal case. The vertical line marks the descent flare. The red curve is the available thrust ceiling.

Thrust limits follow the AIR_NOMINAL envelope versus gas use. The adverse case reduces available thrust and exhaust speed, increases lag and adds 20 kg. Contact uses the common vertical travel of four supports on level ground. Roll, pitch and individual contact order still need coupled verification. The DEV25 5 m campaign remains 0/4.

Animation · Calculation and assumptions

RR H1 landing in the coupled model

Both runs touch down faster than the 0.50 m/s downward gate. After contact a rear damper rod exceeds the model limit of 1.00 m/s. Settled rest on four wheels and the reserve at rest remain open.

Quantity	Gas step 12 ms	Gas step 6 ms
Airborne, s	0.539	0.488
Horizontal displacement to contact, m	2.70	2.44
First wheel	RL	RR
Downward contact speed, m/s	1.63	1.44
Roll at contact, deg	0.76	-2.60
Pitch at contact, deg	1.49	0.63
Peak damper rod speed, m/s	1.0371	1.0019
Air at solver end, kg	206.73	207.91



Finer step. The vertical line marks first contact.

The coarse run records RL followed by RR. On the finer step only RR loads before termination. Contact order is step-sensitive. Both traces end above the 23.53 kg mass floor. This occurs 15–18 ms after contact at about 5 m/s horizontal speed.

Animation · Results and protocol

Verification and reproduction

The machine-readable summary connects results to the time series, events and acceptance tolerances. The step comparison measures sensitivity to discretisation. Physical qualification requires telemetry, actuator characterisation and contact testing.

Check	Recorded result
4100 mm touchdown	PASS. Touchdown tilt 0.239° and horizontal speed 0.149 m/s. Whole-run peak stroke 60.0 mm. Airborne tilt and yaw peaked at 1.265° and 6.003°. Peak thrust 26.011 kN.
5250 mm touchdown	PASS. Touchdown tilt 0.279° and horizontal speed 0.146 m/s. Whole-run peak stroke 60.0 mm. Airborne tilt and yaw peaked at 1.265° and 6.003°. Peak thrust 26.011 kN.
Landing criteria	Downward and horizontal speeds <0.70 and <0.35 m/s. Tilt <1°. Stroke ≤180 mm and total reaction ≤3 weights. Settling follows a 1 s hold on all four supports.
Time-step refinement	PASS. RK4 at 2.5 and 5 ms. Maximum differences were 0.002 mm in position and 0.004 ms in touchdown time.
R4 axial benchmark	Independent 1 m/s zero-thrust case. Stroke 80.291 mm, peak reaction/weight 1.72823.
Sensitivity checks	2,640 kg mass 2/2. Actuator lags ×1.8 0/2 (outside criteria for 4100, 5250 mm). 60 N lateral force 0/2 (outside criteria for 4100, 5250 mm).
Post-contact clearance	Rebound limit 15 mm. Slower actuators gave 26–33 mm, and lateral force gave 20–25 mm. All sensitivity runs achieved settled support.
FCStd 4100	SHA-256 a5a98a4d60fe5720…
FCStd 5250	SHA-256 220ff95325335af6…
Summary SHA-256	1643f3884aff664ab7b4bd54…

P1 · both layouts reached rest with over 60 kg remaining. Events and fuel reserves agree at two integration steps.

Contents of the comparison package

The flight model, machine-readable results, inputs and assumptions accompany the report. The 3D atlas and cost calculators retain their existing input references. Roadster fuel estimates, cost rates and PTS bounds retain their stated scopes.

Musée de l’Air et de l’Espace · AAMS, p. 22 · LLTV · NASA SP-2004-4535 · Tesla Q3 2026