PURPOSE AND STATUS

# Technical specification for alternative Tesla Roadster Rocket designs

Revision 1.1 for expert committee decision • 23 November 2026 • R5/C6I

Develop and compare three upgrade options. The owner's goal is to outperform the original Rocket by 20% in comparable disciplines. The preferred design is a single C6I vehicle within its existing external envelope, with no external rotors and with controlled landing. The committee will select the architecture after bench measurements and a resource balance for one complete vehicle configuration.

## Work ready for approval

| Option | Proposal for approval |
|---|---|
| **V1 • single AIR-powered C6I** | Lead candidate for investigation. Study independent feeds, mass reduction, heat input and revised gas storage packaging. Retain the DEV44 cold-gas configuration as the control case. |
| **V2 • alternative working fluid** | Commission a separate preliminary assessment if the mass and AIR studies are unsuccessful. Changing the operating principle and project scope requires a separate decision by the owner. |
| **V3 • C6I-Flight and C6I-Track** | Study this fallback in parallel. Issue separate configuration records and test the stunt and road vehicles separately. This option changes the scope of any claim made for a single configuration. |

## Baseline results

DEV44. In the attempted 2.5 m cycle, the centre of mass (CoM) reached a peak world-frame height of 1.636 m. Four-wheel hold time was 0 s and peak RL rod speed was 1.0502 m/s. The interrupted run used 98.42 kg of AIR and 0.00238 kWh from the auxiliary bus. A separate return without a turn produced a 0.204 m CoM rise, a 0.50 s hold and a peak rod speed of 0.7638 m/s. The main 5 m series still stands at 0/4.

This is a draft technical specification. The DEV45 baseline review covers the saved DEV44 records and test rig status. The design decision remains open. Committee sign-off, physical measurements and the new simulation each require a separate record. The schedule below depends on test facility availability.

BASIS FOR SELECTION

# How to select the architecture

The final decision is due at the end of week three, provided the committee has accepted the component performance maps.

| Criterion | V1 • single AIR configuration | V2 • alternative fluid | V3 • two configurations |
|---|---|---|---|
| **Design intent** | One body and one configuration for the entire programme. Thermal assistance requires extra energy. | Both the thrust-generation principle and the working fluid change. Compare the resulting functions under a separately agreed specification. | Shared platform, two masses and equipment configurations. Flight performance belongs to Flight, range and top speed to Track. |
| **Advantage** | Can demonstrate the capabilities of a single configuration while keeping AIR as the main resource. | Offers more candidate solutions if the original mass target proves unattainable. | Separates competing battery, gas and packaging requirements. |
| **Main uncertainty** | Mass, usable gas, time-dependent flow and thermal power must all satisfy their limits together. | The source lacks a dedicated data sheet, demonstrated cabin compatibility and a defined operating regime. | Mass savings and freed volume remain unverified. Two qualification programmes and two servicing configurations are required. |
| **Condition to proceed** | At the lower bounds of measured performance, the model retains its landing reserve. Dated supplier proposals, installation layout and energy balance have been verified. | The committee approves the change of requirements. A qualified contractor supplies an independent assessment, resource data and limits for the self-contained module. | Both configuration records are signed. Envelope, mass and separate energy budgets are verified. The targets assigned to each configuration have been agreed. |

### Decision rule APX-01

Assign each option one of three decisions: proceed, return for measurement, or exclude. Record the deciding constraint. Keep the selection open if any critical branch lacks performance maps. A capability demonstrated on one configuration earns credit only for that configuration. Obtain specifications, tooling requirements, qualification costs, bench hours and lead times to compare cost and schedule. Cost estimates and contract dates remain open.

The experts propose excluding the current cold-gas layout if the stunt vehicle exceeds 3,100 kg dry or if the bench cannot deliver a combined ≥165 kg/s without blocking the reserve. The committee must adopt this screening rule. Above 3,400 kg with no feasible route to lower mass, the experts propose evaluating V2. Full-cycle feasibility requires a separate demonstration.

WORKING-FLUID BUDGET

# Evidence required for V1

The gas available before landing and the flow available at each instant are independent acceptance criteria.

DEV44 assigns 129.104 kg in T400 and 77.475 kg in reserve to the vertical circuit. Subtracting the 45 kg protected residual and the 85 kg landing allocation leaves 76.579 kg. Initial mass of the full model is about 3,971 kg. The optimistic static estimates below use dry mass. Mass flow is calculated as $\dot{m} = mg/c$, where c is thrust divided by mass flow, in N·s/kg. The coupled simulation must add flight and transition consumption.

| Screening conditions | AIR for 1.80 s hold | AIR for 2.16 s hold | Shortfall for 2.16 s with existing gas allocation |
|---|---|---|---|
| **DEV44 • 3,663 kg, c = 410** | 157.7 kg | 189.2 kg | 112.7 kg |
| **V1 • 2,800 kg, c = 530** | 93.3 kg | 111.9 kg | 35.3 kg |
| **V1 • sensitivity case, 2,750 kg, c = 560** | 86.7 kg | 104.0 kg | 27.4 kg |
| **V3 • 3,013–3,163 kg, c = 410, without compensating additions** | 129.7–136.2 kg | 155.7–163.4 kg | 79.1–86.8 kg |

### Gas feed AIR-01

Compare a common inlet with independent feeds from the main and reserve sources. In the archived CAD, the Gas2_LiftInlet wall is closed. DEV44 assumes an open connection. This interface needs a design and verification on the fully equipped assembly. The 62.59 kg remaining when the rod speed limit stopped the run does not explain why that gas was unused. For each option, report mass, losses, phase transitions, access to valves and fittings, and response to isolation of one branch.

### Gas availability AIR-02

Use a single run record to show each source's initial and final mass and state, usable residual before landing, and time histories of flow and attitude-control torque. Verify the experts' combined flow target of ≥165 kg/s at agreed temperature, upstream and downstream pressures, duration, valve opening and measurement uncertainty. At 0.2685 s DEV44 first requested 160.20 kg/s against an available 159.83 kg/s. Verify delivery throughout the run as pressure falls, in addition to recording peak bench flow.

MASS AND THERMAL ASSISTANCE

# Packaging the single V1 vehicle

To release this option, provide one bill of materials, one fully equipped assembly model and one set of initial resource quantities.

| Requirement | Work and deliverable | Selection criterion |
|---|---|---|
| **MAC-01 • dry mass** | V1 target ≤2,800 kg. Define dry-mass inclusions and give phase-by-phase vehicle mass with occupants, fluids and gas. Assign an owner, source and range to each of the 93 estimated R08 line items. | Substantiate the 863 kg reduction from the 3,663 kg estimate item by item. The 753 kg of estimated items in another revision include physical parts. Verify the mass statement, CoM, axle loads and full inertia tensor. |
| **КОМ-01 • storage** | Compare the existing 22 modules with series-production composite vessels rated for the chosen fluid. For V1, study reserve vessels with a total internal volume of 350–380 L to replace the current 239.975 L. Use 340 L as the lower sensitivity case. Account for T400 separately. | Verify usable gas mass at actual pressure, temperature, residual and discharge conditions. The 70–90 MPa range under study also requires vessel data sheets, cyclic life data and mount calculations. Determine the existing usable gas inventory independently of a simple pressure ratio. |
| **ТЕП-01 • heat input** | Compare cold gas, pulsed electric heating and a thermal store charged while parked. V1 hypothesis to test: an effective c of 530–560 N·s/kg. Start the sensitivity study at 520. Obtain a complete heat balance and the valve data sheets. | Measure c from synchronised force and flow records and measure temperature and pressure losses. Include mass, heat delivery rate, peak electrical demand, cooling and recovery before the next cycle. |
| **КОМ-02 • installed equipment** | Include valves and fittings, tools, protection, mounts and six HTF cooling sections. Check rack and strut travel, driver space, line routing, assembly order and service sequence. | Confirm freedom from interference and acceptable clearances under tolerances and deformation. Show access to every valve, the replacement sequence and post-assembly checks. |

Thermal assistance carries a power requirement. At 51.8 kg/s, a temperature rise of 250–350 K and an assumed specific heat capacity of 1.0 kJ/(kg·K) imply about 13–18 MW of heat transfer to the gas. This is an order-of-magnitude estimate. Selection requires actual enthalpies, pulse duration and a thermal store energy balance including losses. Verify separately the AIR pilot circuit's two-phase boundary observed in another run.

FALLBACK ARCHITECTURES

# Options V2 and V3

Each option has its own entry condition and scope of comparison with the original.

### V2 • independent review of an alternative working fluid

The experts propose a steam–gas or gas-generator source with an auxiliary air circuit. At this stage, compare the functional performance of complete modules. The working fluid, its storage and the operating limits change the original AIR/$N_2$ specification. The owner and a specialist organisation must decide separately whether to pursue this option.

Ask a qualified contractor for the external interface specification, measured force and resource characteristics, full module mass including protection, thermal effects on the body and occupants, and inspection, failure and shutdown conditions. The expert estimate of 60–70 kg of working fluid consumed remains an assumption until the full cycle and total installation mass have been calculated. Defer V2 if its data sheet, acceptable operating envelope or independent assessment is missing. This option cannot earn credit in the 5 m AIR/$N_2$ matrix.

### V3 • common platform with two configuration records

| Configuration | What to establish | What it can demonstrate |
|---|---|---|
| **C6I-Flight** | Removable traction battery section, with a 25–30 kWh buffer as a hypothesis. Weigh removed and added equipment. Verify the expected 500–650 kg reduction and >250 L of space with structural mounts and cooling included. | With verified inventories, cold AIR, thrust and landing reserve, this configuration can demonstrate its own stunt scenarios. The small buffer must support the simultaneous peak loads of fans, valves, actuators and control power. |
| **C6I-Track** | Full traction battery and road equipment, with the 22 additional gas modules removed. Check mass, axle loads, range, power, cooling and brakes. | Ground speed, braking and range apply to Track. To qualify pneumatic acceleration, identify the installed circuit and initial charge separately. |

For the modular vehicle, issue a drawing of common interfaces, changeover operations, electrical and mechanical connection checks, changeover time and verification after reconfiguration. Compare each vehicle with the corresponding original configuration. If the committee retains the goal that one configuration must perform every task, Flight and Track constitute a programme for two specialised test vehicles. The DEV36 external electric test rig serves as a laboratory for control algorithms.

METROLOGY AND PERFORMANCE

# How to verify a twenty per cent improvement over the original

MET-01. Before simulation, the metrologist records the configuration, initial conditions, measurement procedure, permissible uncertainty and the rule for handling missing data.

| Metric | A • relative to a published bound or agreed reference | B • evidence for comparison with a specific vehicle |
|---|---|---|
| **0–60 mph • Rocket** | <0.59 s gives a target of <0.472 s to reach 26.8224 m/s on a comparable timing basis. | Original timing data, surface, tyres, mass, start trigger and synchronisation. Confirm zero rollout for a direct comparison. |
| **Demonstrated acceleration and rollout** | 0.81 s gives ≤0.648 s. The separate 0.67 s result with rollout gives ≤0.536 s. Each figure uses its own timing convention. | Record the speed at the start of the timed interval and rollout distance. Associate Thrust and Rocket data with their respective configurations. |
| **Speed and driving cycle** | Rocket's >230 mph gives >276 mph, about 444.18 km/h. The model family's >300 miles gives a provisional >360 miles, about 579.36 km. | Obtain the drive cycle and confirm its applicability to Rocket. Fix initial mass, gear ratio, SOC, temperature and a driving-cycle operating mode with no gas consumed for propulsion. |
| **AIR and electricity** | For the same completed task, the maximum target is 0.80 times the original vehicle's corresponding consumption. The dossier lacks complete Tesla time series. | Record a separate gas mass balance for the sources, battery electricity and external-station electricity. For cycles including replenishment, compare equivalent initial and final inventories and thermal states. |

For a higher-is-better metric, require $X_{C6I,lower} \geq 1.20 \times X_{original,upper}$. For a lower-is-better metric, require $Y_{C6I,upper} \leq 0.80 \times Y_{original,lower}$. The metrologist specifies confidence levels, joint coverage and uncertainty for both measurements. A published inequality alone supports a level A result. Define obstacle geometry, seat count, 180°/360° angles and operating limits according to the intended use.

БЕ3-01. Reaching the stated speed from rest in 0.472 s implies mean acceleration of about 5.79 g. Peaks of 6.5–7 g require a time history. Plan uncrewed qualification for record attempts. The experts propose stopping the scenario if acceleration exceeds 5 g for longer than 0.2 s. Individual driver tolerance and restraints require independent assessment. Consider separately whether the 0.648 s case can be crewed. A time result alone cannot clear a driver to participate.

TEST PROGRAMME

# Three test rigs run in parallel

Each rig lead issues a test programme, the metrologist confirms calibration and an independent reviewer signs off the range over which the data are valid.

| Rig and owner | Comparisons and measurements | Outputs for simulation |
|---|---|---|
| **AIR_BENCH • pneumatics** | Test the standard T400 alone, the additional branch alone and both together. Measure pressure drop and test isolation. Use one time base for commands, actual positions, upstream and downstream pressures, temperature, mass flow and all three force components. | Supply and force maps with lower bounds, scatter, delays, remaining inventory and mass-balance error. Supply separate AIR and $N_2$ data and the pilot stage's valid phase envelope. V1 requires a separate map with thermal assistance and its energy balance. |
| **FR_RIG • chassis** | Identify the tyre, wheel rim, strut, mount and reference zeros. Measure load versus deflection, lateral stiffness, compression and rebound force–velocity–stroke loops and the onset of bump-stop engagement. | The proposed instrumentation range covers strut rod speeds up to 1.5 m/s and tyre loads up to 55 kN. Report each actual component's measured range and uncertainty. Monitor all four wheels in the model. |
| **SKIRT_BENCH • downforce** | Test the straight pair FL_W0/W1 and the corner pair FL_W0/S0. Run separate tests at ±4.375 mm differential travel, at the 15/225 mm positions (210 mm difference) and at gaps of 1–15 mm. Confirm rig travel before specifying a separate 225 mm differential test. | Synchronise S1–S4 commands, travel, deployment force and resistance, leakage, pressure differential, cable tension and cable holding under fault conditions. Check recovery and whether joints open as the adjacent segment moves. |

Data acceptance. Identify the specimen and revision, sensor locations and ranges, logging and command rates, synchronisation, temperature, input settings, repeat statistics and reasons for excluding records. Retain raw channels and the processing file. Enable independent checks of mass balance, the validity range and uncertainty.

For each mode, identify the first excursion outside the measured map and demonstrate the specified response to signal loss. Confirm rig readiness and approve the test envelope before physical testing. In parallel with rig preparation, teams can inventory masses, check CAD kinematics and replay DEV44 from saved data.

DOWNFORCE AND LANDING DYNAMICS

# Requirements for phase transitions

Downforce establishes the initial condition for travel along a surface. The attitude thrusters and suspension determine the conditions at first contact.

### ЮБ-01 • repeatable deployment and zone failure

Compare positive spring and pneumatic deployment, each with cable retraction. The experts propose 8–12 N per segment and a deployment time of 0.15–0.20 s. Use 0.20 s as the upper design limit for screening and 0.15 s as the stretch target pending approval. Record 128/128 deployment at the instant the last channel physically deploys. Include inverted operation, contamination, wear, misalignment, temperature, retraction and holding. Specify loads on the shoe and retraction actuator.

### ВАК-01 • adhesion to the surface

Test the four-zone system, isolation of a failed zone, double seals and fan power supply. For stationary inverted operation, the experts propose downforce ≥1.25 times vehicle weight, or 34.3–43.6 kN at 2,800–3,557 kg. The archived result at a 1 mm gap was 8.598 kN against a weight of 34.884 kN. At the higher mass and a pressure differential of 35 kPa, the ideal effective area must be ≥1.25 m². The proposed 0.85–1.15 m² range covers only part of the load envelope. Verify losses, leakage, force distribution and a zone failure before acceptance.

### ОРИ-01 • attitude, braking and contact

The controls team compares the baseline and two-loop control laws in the same model. Verify that entry into final braking requires absolute roll and pitch ≤3.5° and angular rates ≤0.05 rad/s. Separately demonstrate an achievable exit if the remaining time, torque or gas makes that entry envelope unreachable. The episode-specific landing limits still apply. Evaluate candidate control rates of 500–1,000 Hz, four altimeters and a 300 ms prediction horizon with actual delays, noise, loss of a sensor and loss of one supply branch.

### ПОД-01 • impact and strut rod limits

Compare a progressive hydraulic bump stop, two-stage damping and a controlled strut, including a magnetorheological option. In the coupled $N_2$ run, tilt reached 20.28° and only FR carried load for the first 29.5 ms. The tyre load was 48.23 kN and the mount’s axial compressive load was 26.86 kN. A position of +8.123 mm with bump-stop engagement starting at +8 mm indicates entry into the buffer. Check the hard stop separately. In DEV44 the first rod-speed exceedance occurred at RL. Acceptance requires records of both regression cases and all four channels.

EPISODES AND CRITERIA

# What the coupled model must demonstrate

The project sets the stretch values below relative to an agreed scene or nominal value. Claims about the original Tesla additionally require level B metrology.

| Test | Working and stretch series | Grounds for withholding acceptance |
|---|---|---|
| **HOV / YAW** | World-frame centre-of-mass (CoM) Z of 2.50±0.15 m for ≥1.80 s → 3.00±0.12 m for ≥2.16 s. Maximum absolute Vz 0.15→0.12 m/s, drift 0.25→0.20 m. Separate ±180° turns in ≤1.40→1.12 s. Heading error and residual yaw rate ≤3° and 3°/s → 2.4° and 2.4°/s. | Failure to maintain a continuous hover plateau, or heading error or residual yaw rate outside tolerance. Record intervals of saturation. Also run the intermediate 1.12 s turn at 2.5 m. |
| **RAM-P / RAM-R** | Two attitude interpretations on the same CARBON profile. Lip at 20.85 m and 170°, width 4.50 m. Normal reaction to weight ratio 1.80→2.16. Rigid-part clearance ≥25→30 mm. | Departure before the lip, body contact, or vehicle nose pointing across or against the rollout direction. Verify ramp stiffness at the actual vehicle mass, both axles, heading and rollout. Include any gas-generated downforce in the balance. |
| **ROW / ENC** | ROW without a ramp, five fixed obstacles, 360° barrel roll, CoM Z ≥8.20→9.84 m, range ≥39.30→47.16 m, clearance ≥0.20→0.24 m. Separate ENC barrel roll by the tower, Z ≥6.00→7.20 m, drift ≤0.25→0.20 m. | Vehicle envelope intersects an obstacle or the landing trace is missing. Ramp approach speed applies to RAM. For ROW, verify that the climb and roll onset are compatible. |
| **WALL / CEIL / AERO** | On a 90° vertical surface, hold ≥1.00→1.20 s with displacement ≤25→20 mm. Test CEIL separately, stationary with wheels uppermost. Cornering in both directions at 2.0→2.4 g for ≥1.00→1.20 s. | Loss of sealing or contact. Test a zone failure. Separately compare fixed and active aerodynamic surfaces under identical inputs. |
| **LAND for RAM** | Roll/pitch at contact ≤3°/4° → 2.4°/3.2°. Wheel-point speed normal to the surface ≤1.80→1.44 m/s, body load factor ≤3.8→3.04 g, each rear support load ≤53→42.4 kN. | Departure from the boundary, impact by a fixed part, exhausted travel or incorrect heading. End-of-rollout limits ≤3°/0.05 m/s → 2.4°/0.04 m/s. |

Start each episode from static equilibrium or an approved approach. Carry gas mass, position, velocities, attitude, temperatures and state of charge (SOC) through each transition without resetting them. The CARBON source and target animation define the geometry and reference points. Flag the first departure from the measured operating envelope in the record.

GROUND OPERATION AND OCCUPANT PROTECTION

# Braking and maintaining egress

Requirements apply at the actual mass of each variant. V1 must also complete the road and stunt programmes in the same configuration.

### ДОР-01 • speed, brakes and tyres

For the same aerodynamic characteristics and air density, increasing speed by a factor of 1.20 increases the power required to overcome aerodynamic drag by a factor of 1.728. At constant mass, kinetic energy rises by a factor of 1.44. For 3,000 kg at 276 mph, this is about 22.8 MJ. Assessing a particular disc’s temperature or failure also requires the distribution of energy and heat transfer.

Compare C/C and C/SiC brakes with the baseline in terms of brake torque maps, thermal margin, wear, manufacturing and service. Assess cooling and a separately powered air brake with an operating angle up to 80°. Obtain the tyre supplier’s permissible combinations of speed, load, pressure, temperature and duration around 445 km/h. Separately test loss of the control channel, braking without regeneration or downforce, and loss of the air brake. Set the path, heading and heating conditions in the programme before the test.

### КУЗ-01 • frame, door, protection and egress

At R10 the minimum nominal glazing clearance is 1.991 mm. Assess increasing it to 6–8 mm, a floating elastomeric seal and a load path to the main frame that bypasses the hinges. Check against door equipment, sealing, tank mounts, seat and anchors. Test the jamming hypothesis using actual deformations and tolerances.

Require analysis and testing of a representative assembly, followed by opening of both the standard exit and an independent mechanical exit under power loss and specified distortion. Develop a protective bulkhead separating the cabin from the pressure vessels and substantiate its load cases. Refer any active emergency device for a separate specialist assessment. Return the design to its owner if the glazing makes contact, opening force exceeds its limit or egress is blocked.

### ЭН-01 • coverage of the driving and energy cycle

For range and consumption, state mass, usable energy, speed, environment and pneumatic system state. Approve a comparable drive cycle. HWFET can serve as a separate highway test. The link between Tesla’s original figure and the chosen cycle remains open. Record energy at the respective boundaries for traction, fans, heating, auxiliary loads, gas preparation and cooling. For repeat series, report external station energy and recovery time.

VERIFICATION AND QUALIFICATION

# Series acceptance conditions

Issue separate digital acceptance and physical qualification reports for each configuration and environment.

| Check | Required evidence |
|---|---|
| **B2, HOV and SC03** | B2 requires a 2 m CoM rise from the initial position. Next, run the turn at an absolute Z of 2.5 m, then the 3 m stretch HOV. SC03 requires a CoM rise ≥5 m from the initial level. Identify the apex by the change in sign of vertical velocity. SC03 requires four completed runs from rest with HUMAN85. For each of AIR and $N_2$, run nominal and degraded (+20 kg and 90% supply in each branch). |
| **Common landing hold** | Each of the four wheels must carry >100 N continuously for ≥0.50 s (stretch ≥0.60 s). Each rod's speed must remain ≤1.00 m/s over the entire cycle (stretch ≤0.80 m/s). Throughout the simultaneous hold, total CoM speed ≤0.1 m/s, absolute Vz <0.06 m/s, each angular rate component <0.03 rad/s, slider speeds <0.03 m/s and normalised GX/GZ commands and actual openings <0.005. Apply the rest condition to the yaw channel as well. Reset the timer on any violation. |
| **Attitude, supports and landing area** | For SC03, body-axis tilt ≤15° at first contact and at the end, rear mount loads ≤53 kN and positive body clearance. Approve the SC03 footprint and heading tolerance. Apply the additional LAND limits on the preceding pages to the ramp. Record the entire rollout. |
| **Convergence and degraded cases** | Compare Δt, Δt/2 and Δt/4 at the same command rate. Differences between the final two time steps must be ≤5 mm, 2 ms, 0.01 m/s and 2% for resource use. For the declared configuration, expand the matrix to AIR/$N_2$ × nominal, +20 kg, −10% supply and both degradations together. Document loss of a zone, valve or signal in separate fault tests. |
| **Variation and repeatability** | After all mandatory deterministic cases, require 500/500 successful independent runs for each approved input distribution. The one-sided 95% lower bound of approximately 99.40% applies to that probability model. Keep tuning data separate from the validation sample. For physical qualification, run three consecutive cycles and record temperature, replenishment and recovery time. |

Record the exact CAD, code and input versions, units, reference zeros, raw time series, first criterion violated and validity limits. On the showcase, label the original episode, current C6I and specific candidate separately. Show time, AIR, remaining inventory, energy and the frame at the first limit reached. An independent reviewer repeats the acceptance check from the original records.

SCHEDULE AND RESPONSIBILITY

# Implementation plan and committee decisions

Day 1 is the day on which responsibilities are assigned and the baseline revision is handed over. The schedule below is a work plan. If mandatory evidence is missing, revise the date and keep the corresponding stage open.

| Stage and owner | Work and dependencies | Decision material |
|---|---|---|
| **1 • Days 1–2. Chief engineer and chief metrologist** | Freeze C6I, the state of the mass register, source performance data, A/B entries and crewed/uncrewed targets. Prepare a request for calibrated source records for episodes at 06:03, 10:56 and 15:58. | Baseline configuration record, uncertainties, open decisions, owners, completion and abort conditions. Approve the technical scope of the three rigs. |
| **2 • Week 1. The three rig leads** | Prepare or run AIR_BENCH, FR_RIG and SKIRT_BENCH in parallel. Procure or request measurement services after scope approval. In parallel, measure V1/V3 masses and available volumes. | Three datasets with calibration and validity envelopes. If equipment is unavailable, give the agreed date, supplier, outstanding channels and work that can proceed independently. |
| **3 • Weeks 2–3. Chief engineer, energy systems lead and procurement** | Incorporate maps in DEV45, assemble fully equipped CAD, mass register, inertia and balances by phase. Compare V1 with V3. Conduct separate preliminary screening of V2. | Selection sheet covering gas mass required and available, time-dependent supply, heat, installation, cost and lead time. Record reasons for rejection. The full manoeuvre remains open until resource balances close. |
| **4 • Weeks 4–6. Dynamics, controls and independent reviewer** | After the stage 3 decision, reproduce the DEV44 control run, low-height return, B2, ±180° at 2.5 m, stretch HOV and SC03. Run the ramp, row, tower and ground scenarios separately. | Traces, time-step comparison, statistical sample, fault log and outstanding data. Issue acceptance by mode. Six weeks is the planning estimate for the digital stage. |
| **5 • When ready. Test, safety and manufacturing teams** | Issue the engineering design documentation and manufacturing controls. Verify brakes, egress under distortion, and vessel and mount qualification. Proceed to an uncrewed landing with a restraint under an agreed programme, followed by repeat cycles. | With a restraint, measure the external force and record its contribution. Release for a defined scope of use with a change register, service materials, inspection results and the owners' signatures. Schedule physical qualification separately. |

Track the five R5 priorities in parallel: full manoeuvre, skirts and downforce, mass and thermal power, chassis and brakes, structural load path and egress. A new flight series requires evidence over the whole run. An individual geometric interface or local hold demonstrates only that specific condition.

TRACEABILITY AND RELEASE

# Closing the expert committee’s questions

Every record carries the question ID, variant, owner, source, due date, uncertainty, decision and trigger for reconsideration. The table maps to sheet 02 of the source dossier.

| Questions | Required output from the owner |
|---|---|
| **ЭК-01 / 02 / 03 / 04** | 01 — provenance and metrology for the original vehicle. 02 — signed A/B matrix. 03 — assembly and interface record. 04 — BOM, weighing, axle reactions and inertia tensors. |
| **ЭК-05 / 06 / 07 / 08** | 05 — pneumatic architecture comparison. 06 — separate and combined supply maps. 07 — vessels, mounts, service life and maintenance. 08 — validity envelopes for AIR and $N_2$, including the phase boundary. |
| **ЭК-09 / 10 / 11 / 12** | 09 — attitude-control torque and available reserve. 10 — continuous hover plateaus. 11 — deployment, retraction, cable and S1–S4. 12 — four zones, leakage map and single-zone failure. |
| **ЭК-13 / 14 / 15 / 16** | 13 — FR maps and coupled landing cycle. 14 — load path and egress. 15 — two ramp trajectories. 16 — separate five-obstacle row and tower manoeuvres. |
| **ЭК-17 / 18 / 19 / 20** | 17 — acceleration and rollout record. 18 — steering, aerodynamics and braking under faults. 19 — consumption, thermal conditions and recovery. 20 — fully equipped CAD, design documentation, tolerances, procurement and maintenance. |
| **ЭК-21 / 22 / 23 / 24** | 21 — independent review and four 5 m traces. 22 — abort procedure and authority. 23 — checksums, synchronisation and frames. 24 — signed selection, owners, dates and funding. |

## Basis for this revision

Expert response supplied by the owner on 23 November 2026. Lines 9–26 cover metrology, 34–66 the five physical constraints, 70–79 the three variants, and 83–99 the plan. The source text’s SHA-256 digest appears below. TextToCAD materials are in EXPERT_COMMITTEE_20261123. For independent verification, consult DEV22/ACCEPTANCE_RU.md, DEV36/requirements/EPISODES_RU.md and ACCEPTANCE_MATRIX.json, DEV43/START_RU.md, and DEV44/geometry.json, capacity.json, replay.json, low_return.json and verification.json.

Expert input • c06e063ec18876cbcc3ef5c1a58fe981f183bee9d69b3c708ac2819d20499030
Native C6I • 645db17f4717f4747ead48376ecbf3b6deee1fb5496e6efd0f7809a25d47c85a

## Approval

Chief engineer _____ Chief metrologist _____ Project owner _____

Selected variant _____ Mandatory conditions _____ Decision date _____

Evidence and baseline · Tesla presentation · Tesla configurations · EPA drive schedules · NASA model verification