

VesselPlanner

Stage-by-Stage Mode Tutorial

KSP1 • VesselPlanner 0.7.74

Stage-by-Stage mode lets you design an entire vessel one stage at a time before building it in the KSP editor. Each stage is either an Engines & Tanks propulsion stage or a Subassemblies stage made from saved KSP subassemblies. VesselPlanner carries the complete mass of every finished upper stage into the stages below it.

Core idea: Design from the payload downward. Stage 1 is the first stage directly under the payload; each later stage carries the complete wet mass of everything already designed above it.

Quick Workflow

Step	Action	What it does
1	Set payload	Enter or verify the mass Stage 1 must carry.
2	Optional mission link	Select a saved Mission Planner plan if you want the mission to drive the stage definitions.
3	New Stage	Choose Engines & Tanks or Subassemblies and define that stage.
4	Calculate	For propulsion stages, let VesselPlanner find engine solutions that satisfy the requirements.
5	Select engine	Choose the engine/count combination you want.
6	Select tank set	Choose a compatible one-, two-, or three-type tank set.
7	Add & Done	Record the stage hardware, then continue downward.
8	Finalize	Convert the completed plan into a VAB/SPH build list.

1. Understand the Stage Order

Stage-by-Stage works from the top of the vehicle downward. The original payload is at the top, and Stage 1 is the first stage directly beneath it.

When you create Stage 2, VesselPlanner treats the payload plus the complete wet mass of Stage 1 as the mass Stage 2 must carry. Stage 3 carries the payload plus Stages 1 and 2, and so on.

1. Payload or existing upper spacecraft
2. Upper stage — Stage 1
3. Next stage below it — Stage 2
4. Continue downward through lower stages
5. Design the booster or launch stage last

Important: This is a design order, not the order the stages fire on the launch pad. Ask “what must this stage carry?”

and work downward from the payload.

2. Start a New Stage-by-Stage Plan

Open VesselPlanner in the VAB or SPH and select Stage-by-Stage from the left group of mode buttons.

The Stage-by-Stage Plan window opens below and left-aligned with the main VesselPlanner window. New/Edit Stage opens immediately to its right. When solid editor backgrounds are enabled, these windows use the lighter Stage-by-Stage underlay for visual separation.

Vessel: the name used for the plan and saved plan file.

Payload (t): the mass carried by Stage 1. If a vessel is already in the editor, a new plan initializes this from the vessel's full wet mass. If the editor is empty, the default is 5.0 t.

Starting body: the celestial body currently selected in the main VesselPlanner window. This is the starting environment for unlinked stage calculations.

Do not double-count payload: Payload/Previous stages mass is handled separately. Additional Cargo Mass is only for hardware that belongs to the propulsion stage currently being designed.

3. Optional: Drive the Plan from Mission Planner

If you have already described the mission in Mission Planner, click Select Mission Plan and choose the saved mission.

The selected mission appears in a sidebar with the last mission step first. The Stage-by-Stage plan name is initialized from the mission plan name and remains editable.

Clicking a mission line opens the matching stage type:

- Engines & Tanks mission step — Target Δv and ASL/VAC basis are copied into an Engines & Tanks stage.
- Subassemblies mission step — every saved subassembly, Count, and Decoupler flag is copied into a Subassemblies stage.

Clicking a mission line that is already linked to a stage opens that existing stage for editing instead of creating a duplicate.

When Calculate is used on a mission-linked stage, VesselPlanner derives the Planning body/environment from the mission history. When the relevant body comes from a transfer, the transfer destination is used.

Mission tutorial: For building the mission first, see Manual/VesselPlanner-Mission-Planner-Tutorial.docx.

4. Create a Stage and Choose its Type

Click New Stage. Every stage is one of two mutually exclusive types:

- Engines & Tanks — use the delta-v/TWR solver, then choose an engine solution and compatible tank set.
- Subassemblies — build the stage directly from one or more saved KSP subassemblies. This mode does not open the engine/tank solver.

Changing the stage type changes what is saved for that stage; one stage does not simultaneously contain propulsion solver data and a Subassemblies-stage definition.

5. Define an Engines & Tanks Stage

For Engines & Tanks, enter the stage requirements before calculating.

Target Δv : the delta-v this stage must provide.

Δv Basis:

- Vacuum — use vacuum engine performance.
- Atmosphere — use atmospheric performance for the selected body/environment.

Minimum TWR: the lowest acceptable thrust-to-weight ratio. Raising it generally requires more thrust and may increase engine count or stage mass.

Max Engines: the largest engine count VesselPlanner is allowed to consider.

Additional Cargo Mass: fixed stage-local hardware not otherwise represented by the selected engine/tanks, such as structure, batteries, landing hardware, or avionics.

Optional stage decoupler mass: include the separator between this stage and the stage above it.

Booster layout options can record Side Boosters, Core burns too, and (when side boosters are enabled) Radial decouplers. These are saved as layout annotations; radial-decoupler mass is not inferred automatically because the number of booster stacks is not known from the engine/tank solution.

Mission-linked stages: When a mission step opened this stage, Target Δv and basis are already prefilled. Review them before calculating.

6. Select Bulkhead Profiles

Bulkhead profiles restrict which engines and tanks are considered so adjacent stages can remain mechanically compatible.

Typical profiles include srf, size0, size1, size1p5, size2, and larger installed stack sizes.

You may select more than one profile. Clear selection removes the restriction.

Stage 1 can inherit a useful profile from the open lower attachment node of the existing editor craft. Later stages can inherit the previous stage engine's lower attachment profile. An inherited profile is only a starting preset; you can replace or expand it.

The selected profile also determines the reference stage-decoupler mass from GameData/VesselPlanner/decouplerMasses.cfg. When multiple applicable profiles are selected, VesselPlanner uses the largest matching configured mass.

7. Calculate the Stage

Click Calculate. VesselPlanner uses the normal Planning solver with this stage's payload/Previous stages mass, target delta-v, TWR, basis, engine-count limit, cargo, decoupler, and profile restrictions.

The Stage-by-Stage Plan stays active in the background while the main VesselPlanner window shows the candidate engines.

Engine Filter and Exclude accept comma-separated terms. Filter is OR matching; any Exclude match removes the candidate. Engine names use KSP localization when available.

8. Choose an Engine

Each candidate row represents an engine/count solution that satisfies the current requirements. Depending on the enabled columns, you can compare:

- Engine and engine count
- Stage wet mass
- Starting vehicle mass
- Atmospheric and vacuum delta-v
- Atmospheric and vacuum thrust
- TWR

- Isp
- Burn time
- Propellant requirement

Click a row to select it. The Selected Engine pane shows more details.

The main VesselPlanner window can be resized horizontally from 1150 to 1850 px. If the table is wider than the visible area, use the horizontal scrollbar; the header scrolls with the rows.

Part thumbnails are shown in the engine list. Hover a thumbnail to see the larger rotating preview using the current Part Images settings.

9. Choose a Tank Set

After selecting an engine, use the Tanks pane to choose a compatible tank solution.

VesselPlanner can solve one-, two-, or three-type tank sets. All tank types in a set share one KSP bulkhead profile.

Tank Filter and Exclude work like the engine filters and accept comma-separated display-name or internal-name terms.

Tank rows can show the tank types and counts, total tank count, dry mass, excess capacity, total capacity, shared profile, and a thumbnail for each tank type.

While a Stage-by-Stage stage is open, the tank action is labeled Add to Stage. A tank selection is required before Add Engine & Tanks can record the combined propulsion solution.

10. Add the Engine and Tanks to the Stage

Once both an engine and tank set are selected, click Add Engine & Tanks.

VesselPlanner records the selected engine, engine quantity, every tank type in the selected set, and each solved tank count in the current stage, then returns the Stage-by-Stage Plan to the front.

Selected tanks, optional stage decoupler, and engines are listed beneath the stage summary. Engine/tank lines include part thumbnails; the summary also shows the saved booster-layout options.

Stage-by-Stage behavior: Add actions record parts in the current plan rather than treating the main Planner as a one-off calculator.

11. Build a Subassemblies Stage

Choose Subassemblies when the stage is composed from saved KSP subassemblies instead of a propulsion solution.

The editor intentionally mirrors Mission Planner's two-list workflow:

- Available subassemblies — saved subassemblies found in the current save.
- Subassemblies in this stage — the entries already selected.

Click Add for each saved assembly, set Count, and optionally enable Decoupler independently for each line. Adding the same subassembly again increases its count.

VesselPlanner uses the saved craft's calculated wet mass. Per-copy decoupler reference mass is selected from decouplerMasses.cfg using the subassembly root part's bulkhead profile(s).

Click Add Stage (or Save Stage while editing) to finish the Subassemblies stage. Its complete mass, including all selected per-copy decouplers, is immediately included in the stages below it.

12. Review, Finish, and Create the Next Stage

Review the stage summary and contents. If a selected propulsion part is wrong, use Remove beside it and choose a replacement.

For Engines & Tanks, click Done when the stage contents are complete. For Subassemblies, the Add/Save Stage action completes the stage directly.

Click New Stage again. For Stage 2 and every later stage, VesselPlanner displays Previous stages mass.

Previous stages mass includes the complete wet mass of all finished upper stages: propulsion hardware/resources, additional cargo, stage decoupler mass, Subassemblies-stage contents, and selected per-copy decouplers.

Recalculate downstream stages: If you significantly change an earlier/upper stage, review the stages below it because their required performance depends on the wet mass above them.

13. Edit Existing Stages

Use Edit beside a stage to revise it.

Engines & Tanks stages can change target delta-v, basis, TWR, max engines, cargo, stage decoupler, booster-layout flags, and bulkhead profiles. Click Calculate again to regenerate candidate engines for the revised requirements.

Subassemblies stages can add/remove saved assemblies, change counts, and toggle per-copy decouplers.

If the stage is linked to a Mission Planner step, its mission-plan name and step number remain associated with it so clicking the same mission line returns to that stage.

14. Save and Load Plans

Save an unfinished plan at any time by entering the desired vessel name and clicking Save. Saved Stage-by-Stage plans are stored under VesselPlanner's PluginData plan directory.

Use Load to reopen a saved plan. Older plans are migrated where possible; plans saved before explicit stage types were introduced load as Engines & Tanks stages.

If a mission plan was selected, the Stage-by-Stage vessel name starts from the mission name but remains independently editable.

15. Finalize the Plan

When every stage is complete, click Finalize. Finalizing turns the design into a practical build list for the VAB/SPH.

After finalization:

- New Stage is disabled.
- Stage editing controls are removed.
- Planned engine and tank lines receive Add actions for normal KSP editor placement.
- Subassemblies stages remain listed with counts and decouplers and are placed through KSP's normal saved-subassembly workflow.
- The main calculation window closes.
- The finalized plan is saved automatically.

Work through the plan from the top and place the required number of each part. If the design must change, click Reopen to return to editing mode.

16. Recommended Mission-Driven Workflow

1. Describe the mission chronologically in Mission Planner and save it.

2. Open Stage-by-Stage and Select Mission Plan.
3. Verify the payload mass.
4. Start with the last mission line at the top of the mission sidebar.
5. Click that line to create its matching Engines & Tanks or Subassemblies stage.
6. For propulsion stages, Calculate, choose the engine and tank set, add them to the stage, and click Done.
7. Continue downward through earlier mission steps as VesselPlanner accumulates the wet mass above.
8. Add any additional structural stages that are not represented by mission steps.
9. Save the Stage-by-Stage plan, then Finalize and build the vessel in the editor.

17. Recommended Standalone Workflow

1. Build or determine the payload mass.
2. Open Stage-by-Stage and verify Payload and Starting body.
3. Create the uppermost stage, choosing Engines & Tanks or Subassemblies.
4. Finish that stage completely.
5. Create the next lower stage and verify Previous stages mass.
6. Repeat until the launch/booster stage is complete.
7. Save, Finalize, and use the result as a VAB/SPH build list.

18. Tips and Troubleshooting

Design top to bottom. Stage 1 is directly under the payload. Each new stage goes underneath everything already planned.

Use realistic TWR requirements. Very high minimum TWR can eliminate otherwise useful engines or force heavy clusters.

Use bulkhead profiles. They keep engine and tank choices mechanically compatible. Mixed tank sets use no more than three tank types and share one profile.

Do not double-count hardware. Use Additional Cargo Mass only for hardware belonging to an Engines & Tanks stage that is not otherwise represented. Hardware intentionally modeled as a Subassemblies step/stage should not be entered again as cargo.

Consider decouplers and layout. Engines & Tanks can add a stage separator and record side-booster layout flags; Subassemblies can add a separator per copy.

Review lower stages after edits. Changing an upper stage changes what every lower stage must carry.

Save during design. A saved work-in-progress is easier to recover than an unsaved plan.

No profile means unrestricted. If expected engines or tanks are missing, verify bulkhead and text filters first.

Summary

Stage-by-Stage repeats one of two cycles:

Engines & Tanks: Define → Calculate → Select Engine → Select Tank Set → Add → Done

Subassemblies: Define → Add Saved Assemblies / Counts / Decouplers → Add or Save Stage

VesselPlanner then carries the completed mass of every upper stage into the next stage below it.