

CAD Engineering Software:

Selection, Requirements, and Workflow



- Tool choice is a design decision, not a purchase decision



- Three pillars: write requirements, run fair selection, build reliable workflow



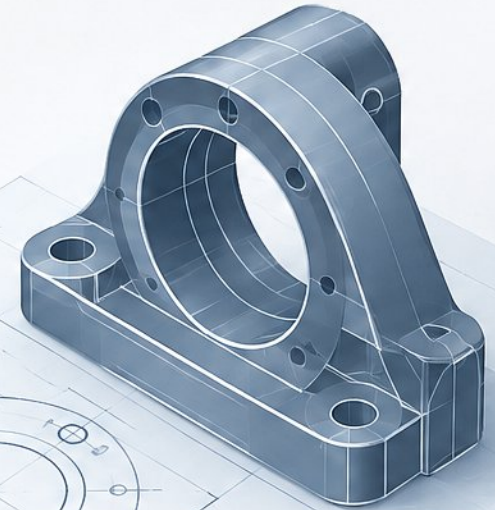
- Deliverables: one-page requirement brief, weighted comparison, validation checklist



- Watch for: feature-led choice, hidden exchange costs, workflow gaps



- Context: 3D holds ~68% of CAD value, but 2D drawings still carry approvals



The 2026 CAD Landscape: Categories and Pricing Anchors

- Seven core categories: 2D drafting, parametric MCAD, direct/surface, BIM, ECAD-MCAD, CAM, cloud-native
- 2D and 3D are separate disciplines: 2D output still drives permits and approvals
- Price anchors: 2D about \$500–900/seat/year; 3D about \$2,500–4,000
- BIM market roughly \$36B in 2026, growing about 10%
- Cloud deployment and AI-assisted drafting drive current growth

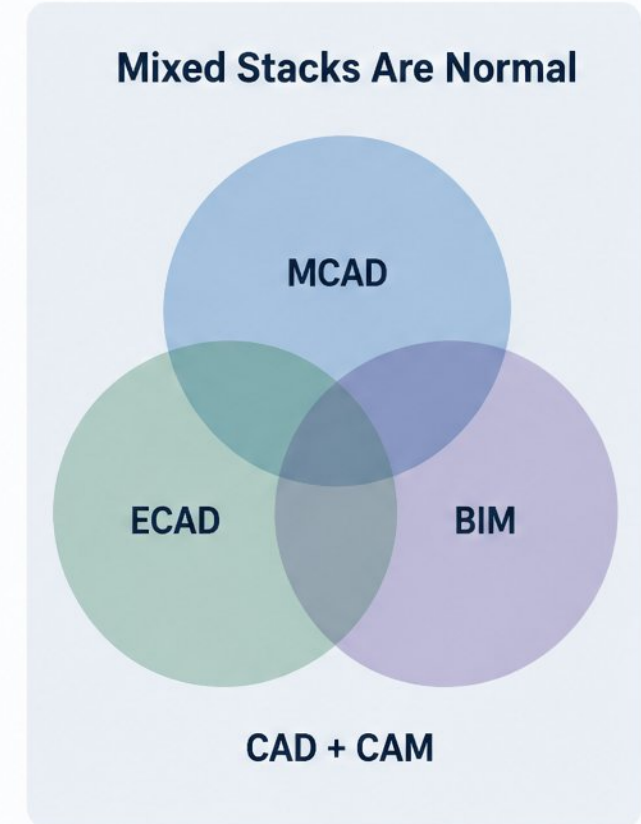
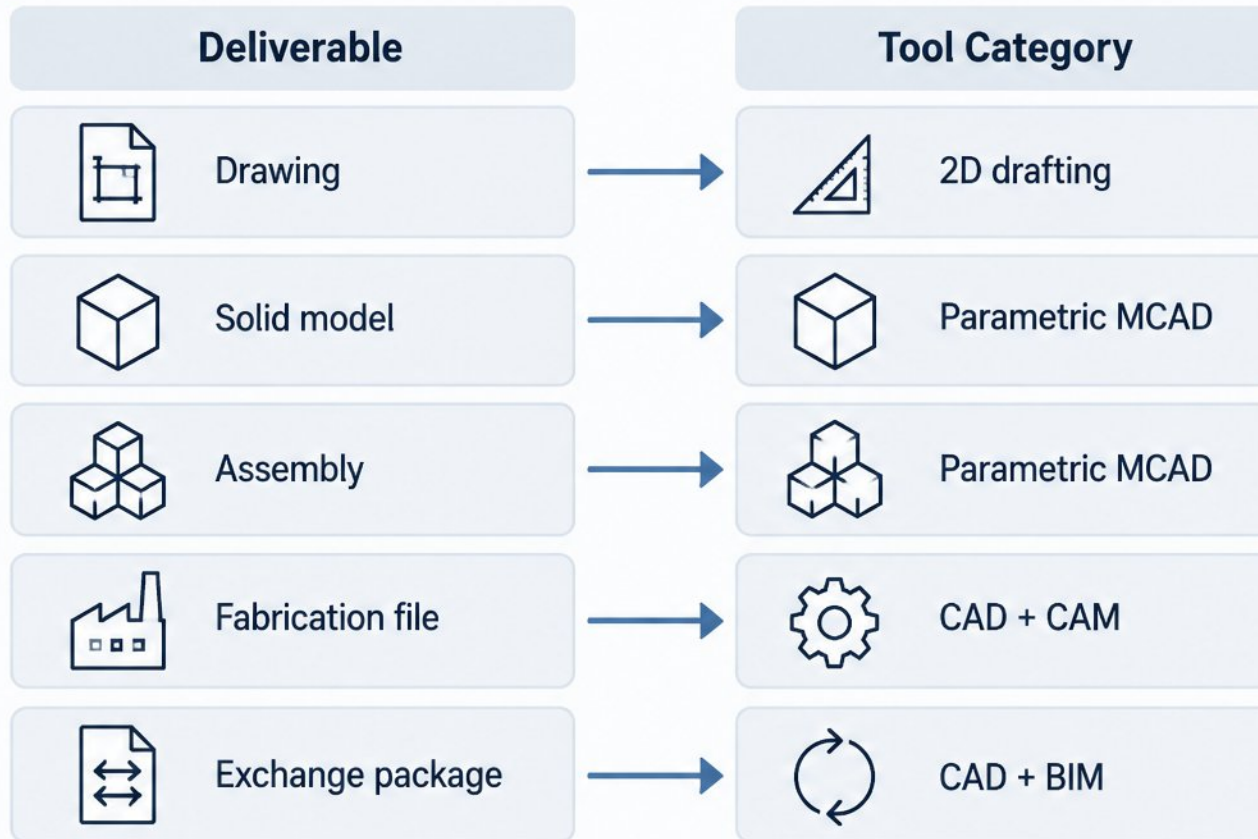


2D
about \$500–900/
seat/year



3D
about \$2,500–4,000

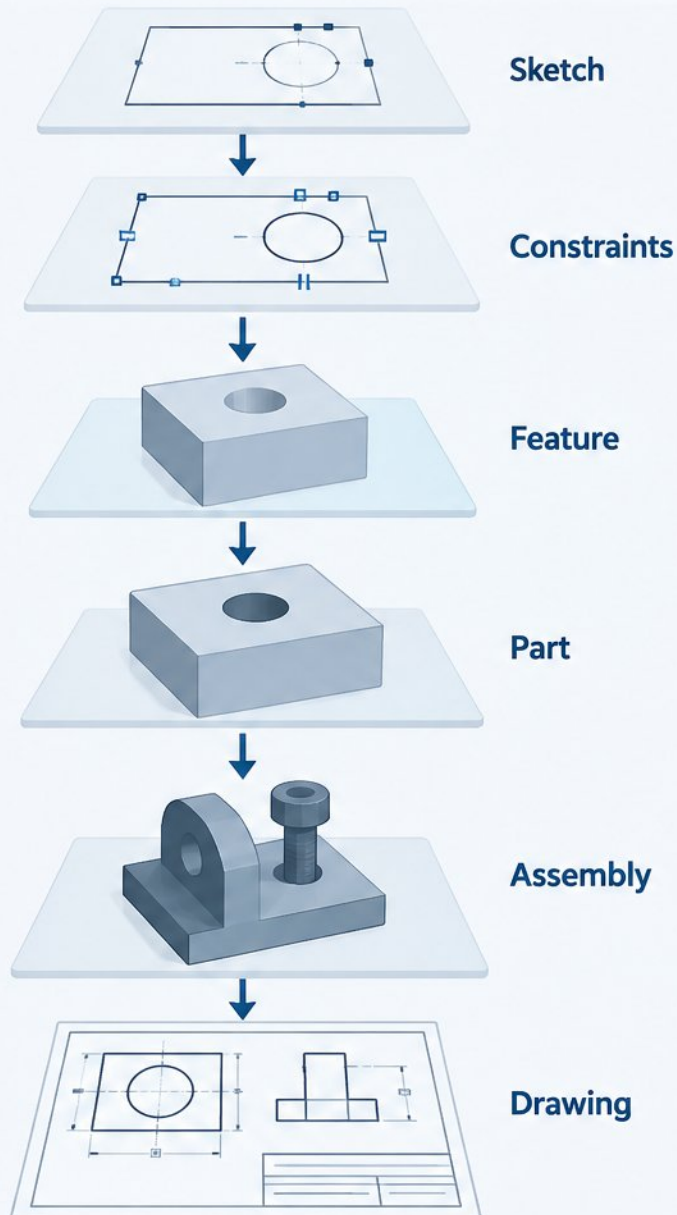
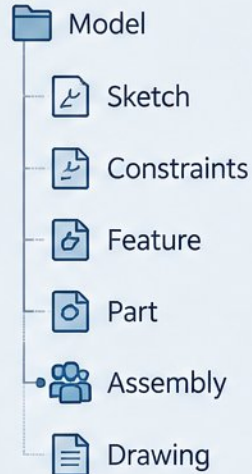
Matching Tool Category to Deliverable



- Start from the deliverable: drawing, solid model, assembly, fabrication file, or exchange package
- 2D drafting fits light AEC, MEP, civil layouts, and 2D-only fabrication shops
- Parametric MCAD for engineered products and assemblies; surface tools for freeform design
- Mixed stacks (MCAD + ECAD, MCAD + BIM, CAD + CAM) are normal, not a failure
- MCAD is about half of CAD value; cloud-native platforms lead small-team adoption

Core Concepts: Parametric Modeling, Assemblies, and Drawing Views

Feature Tree



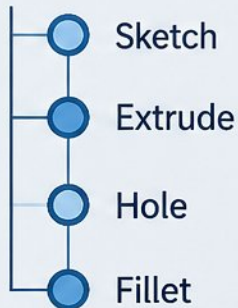
- **Parametric chain:** sketch → constraints → feature → part → assembly → drawing, all editable via the feature tree
- **Design intent** keeps models alive through change: stable references, sensible naming, watch rebuild warnings
- **Assembly basics:** mates/constraints, remaining degrees of freedom, interference checks
- **From 3D to 2D:** views, dimensions, tolerances, and title blocks drive approval and build
- This vocabulary becomes the testable requirements you write later

Parametric vs. Direct Modeling: Choosing Your Editing Style

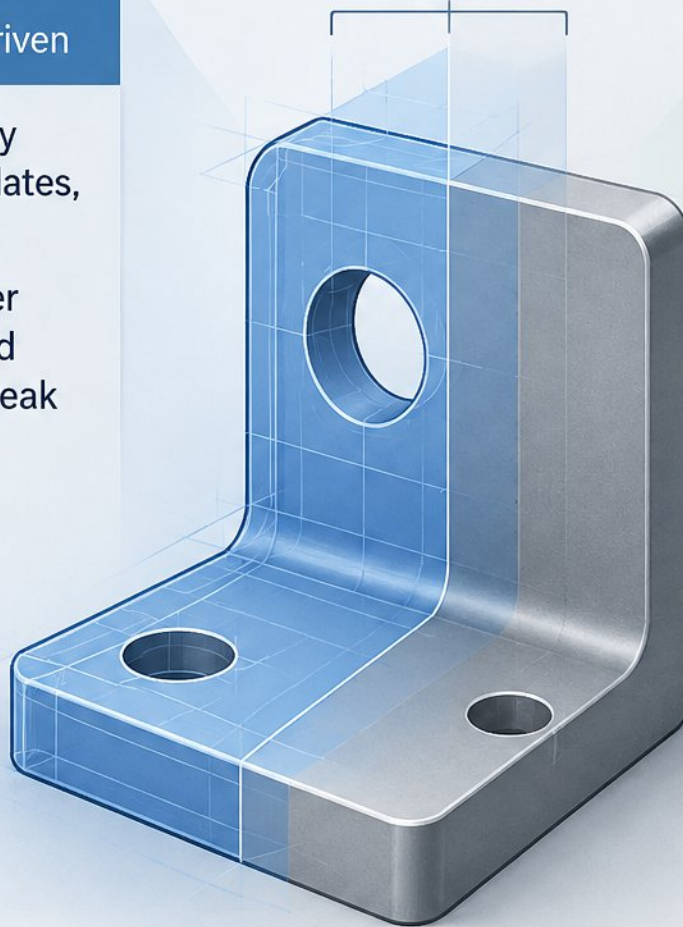
Parametric

History-based, design intent driven

- Parametric: captures history and design intent, auto-updates, strong for part families
- Parametric trade-off: slower concept exploration, rebuild failures when references break



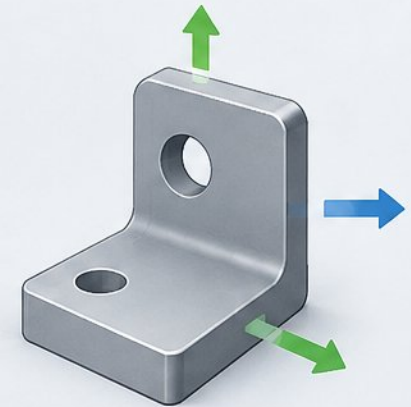
Hybrid



Direct

Push/pull geometry, no history

- Direct: push/pull geometry with no history; fast concepts and easy supplier-file edits
- Direct trade-off: no automatic drawing updates, weak design-intent capture



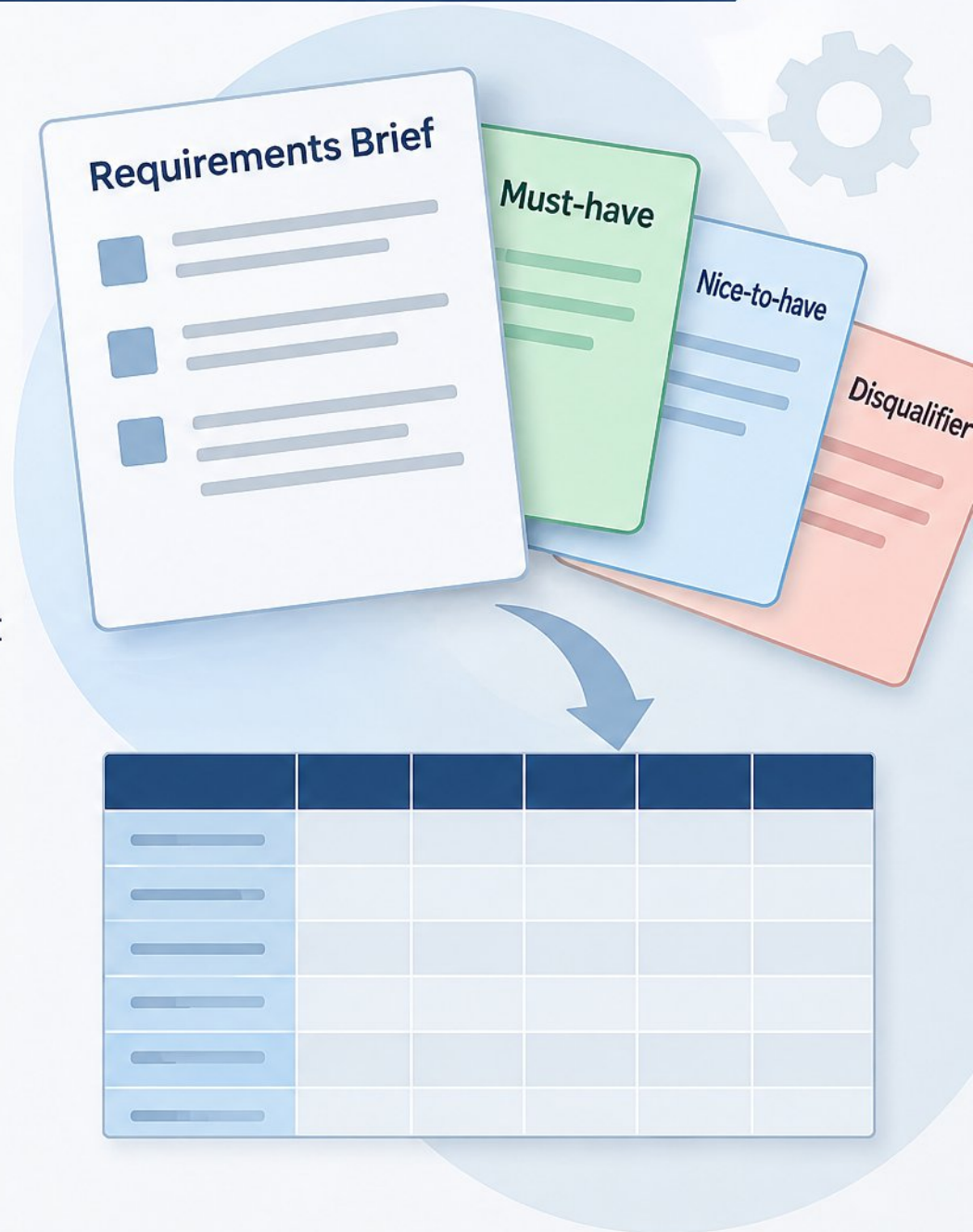
Rule set: parametric for engineered parts and documentation; direct for concepts and imports



Modern tools are hybrid (Creo, Fusion 360, SpaceClaim, Shapr3D); learn parametric first

Turning Design Needs into Testable CAD Requirements

- Gather needs from deliverables, team size, supplier formats, budget, and IT rules
- Classify each requirement: must-have, nice-to-have, or disqualifier
- Customer-mandated tools are hard constraints that override all other factors
- Write measurable tests: "opens a 200-part STEP assembly in under 5 minutes"
- Score candidates 1–5 on 8–10 weighted criteria in a shared matrix
- Reuse one brief template for student projects and junior roles

[illegible]

File Formats and Design Exchange: STEP, IGES, Parasolid, STL, DXF, JT

SHARE DESIGN
PRESERVE INTENT
WORK TOGETHER

STEP (AP203/AP214/AP242)

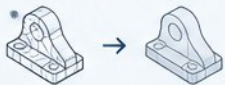
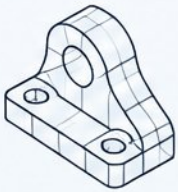
Neutral B-rep



Geometry, PMI, colors and assembly structure generally retained

IGES

Neutral B-rep



Geometry typically retained; PMI, colors and assembly structure can be lost

Parasolid

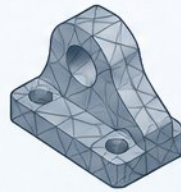
Native B-rep



Geometry and assembly structure generally retained; PMI and colors can be lost

STL/3MF

Neutral Mesh



Geometry as mesh for fabrication and visualization; not for editing

DXF/DWG

Neutral B-rep



2D/3D geometry typically retained; PMI and assembly structure can be lost

JT

Neutral B-rep



Geometry and assembly structure typically retained; PMI and colors can be lost

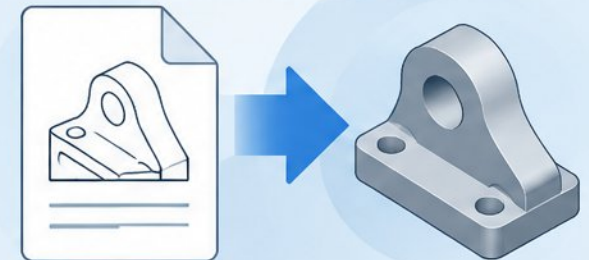
PDF

Neutral B-rep



Visual representation retained; editable geometry, PMI and assembly structure lost

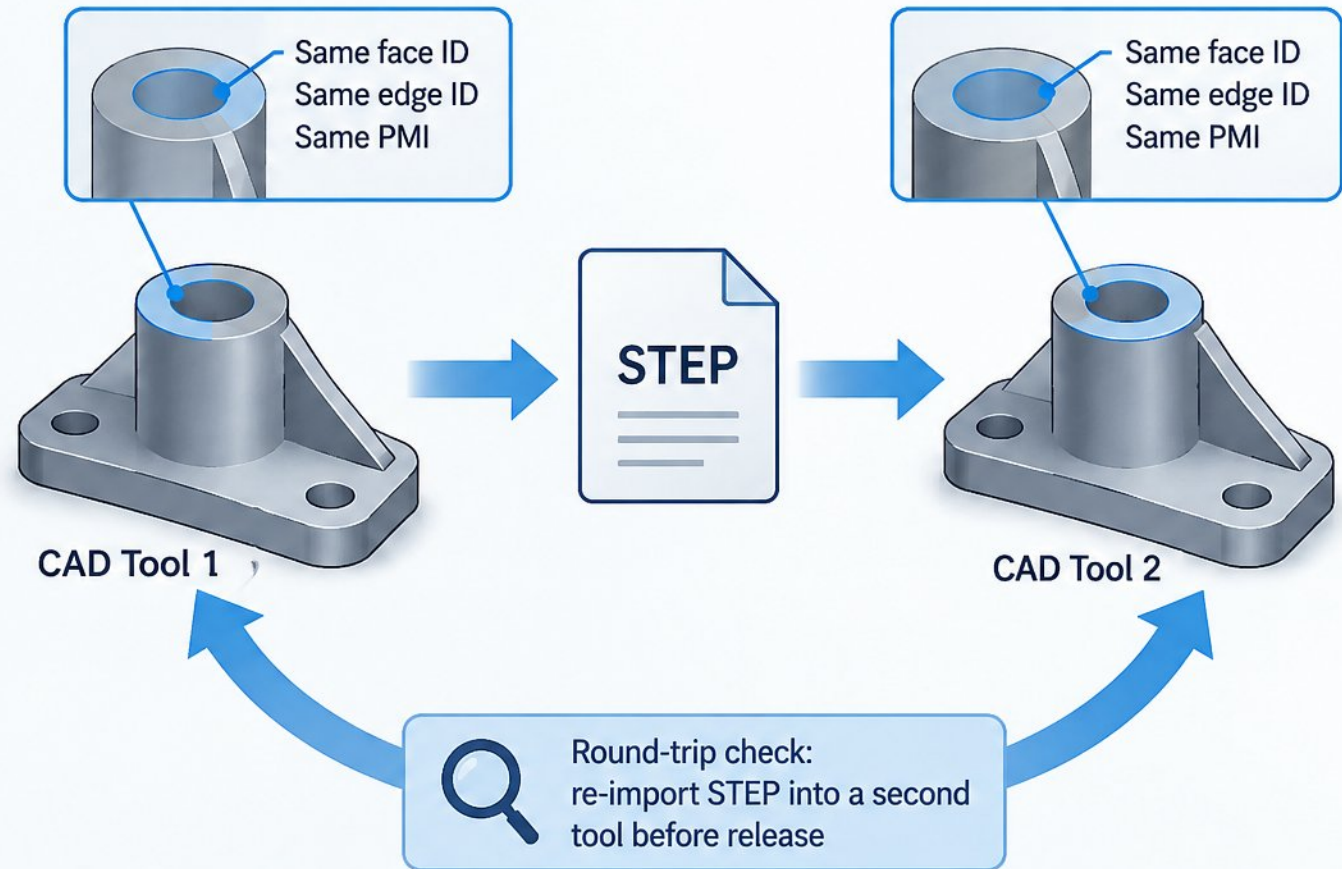
- Neutral vs. native formats: PMI, colors, and assembly structure can silently vanish
- Cheat sheet: STEP (AP203/AP214/AP242), IGES, Parasolid, STL/3MF, DXF/DWG, JT, PDF
- Mesh vs. B-rep: STL and 3MF are for fabrication and visualization, not editing
- AP242 4th edition (August 2025) adds datum-set and tolerance-modifier enhancements
- Pre-send checks: units, origin, tolerance, naming, layer and color retention



SAME IDEAS. FEWER SURPRISES.

Making Exchange Traceable: Persistent IDs and Round-Trip Verification

- Revisions break: recipients lock to one instance and cannot re-map references
- Persistent IDs (V5_UUID_ATTRIBUTE) let systems recognize same faces, edges, PMI across iterations
- Topology differs across CAD systems (one cylinder vs. two half-cylinders), so IDs must be explicit
- Round-trip check: re-import STEP into a second tool before release
- STEP + QIF EntityExternalIds link design to inspection for full digital thread
- CAX-IF Persistent IDs v1.8 recommended practice, March 2026



Licensing, Education Access, and Hardware Reality



- Student access is broad but shifting: Fusion, SolidWorks, Creo, and NX offer free plans



- Autodesk ended new network education licenses in March 2026; expect named-user sign-ins



- CSWA/CSWP attempts cost about \$99; some student plans bundle certification vouchers



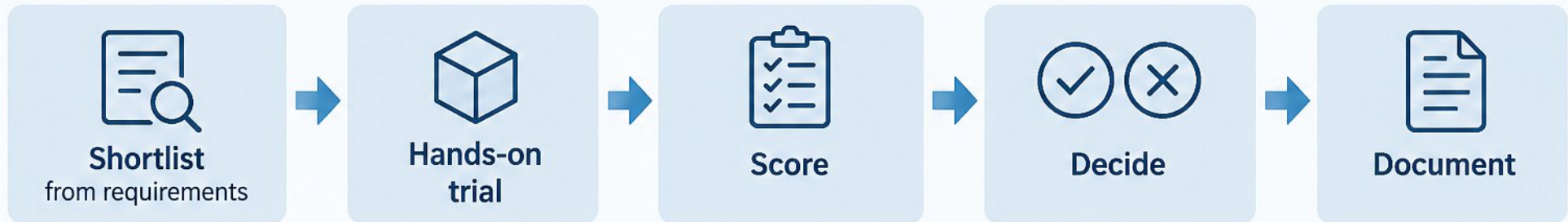
- Desktop MCAD is Windows-only and workstation-hungry; cloud tools run on any device



- Total cost includes hardware, cloud storage, and certification fees—not just the license

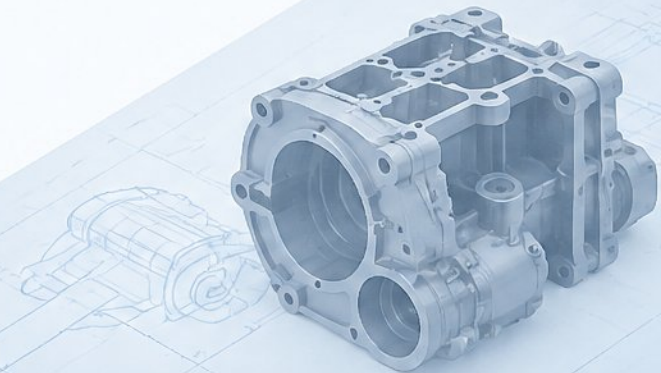


Evaluating and Selecting a Tool: A Structured Workflow

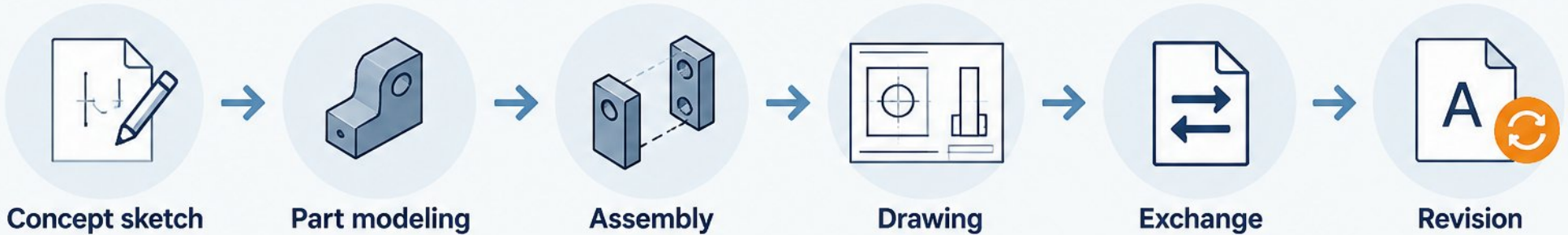


- Sequence: shortlist from requirements → hands-on trial → score → decide → document
- Trial with your own representative part and assembly, never vendor demo files
- Run a 4–6 week proof of concept: one real project plus one supplier exchange
- Evaluate architecture, collaboration, PDM inclusion, performance at your complexity ceiling, ecosystem fit
- Five-year TCO: license model, hardware, add-ons, IT overhead, training (5–10 days per power user)
- Score 0–5 against weighted criteria and record the evidence
- A scorecard you can defend later beats a personal preference

Weighted Scorecard				



Designing a Practical CAD Workflow with Revision Control



- 1 Stages: concept sketch → part modeling → assembly → drawing → exchange → revision
- 2 Shallow folders (~3 levels): CAD, Release, Supplier, Reference; never overwrite released files — add a revision letter
- 3 Letters (A, B, C) for releases; numbers for pre-release drafts; pick one, never mix
- 4 Lifecycle: Work in Progress → In Review → Released, with named approvers and a recorded path back
- 5 PDM Standard or Vault for small teams; shared log or Git LFS for 2–5 disciplined engineers

Folder Structure (~3 levels)



Lifecycle



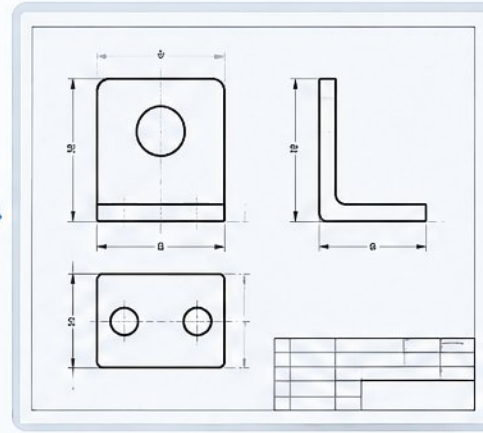
Workflow in Practice: A Bracket from Brief to Exchange Package



Modeled



Assembled



Drawing views



Re-imported STEP
in a second tool



Walkthrough: bracket from requirement brief to exported STEP and released PDF drawing



Exercise every brief requirement in turn — modeling, assembly, drawing views, export



Validation loop: re-import STEP into a second tool; confirm units, origin, geometry, dimensions



Log each step and each break to expose workflow gaps early

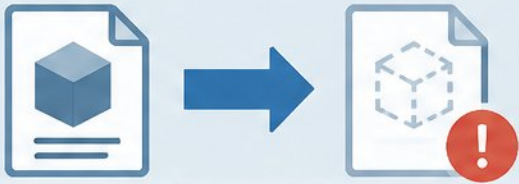


Reflection: what changes if supplier, material, or deliverable changes?

Common Pitfalls and How to Avoid Them



- **Choosing by brand or demo, not requirements:** a demo proves what a vendor can show, not what you can operate



- **Late exchange failures:** PMI or geometry loss surfaces at handoff, after schedule slack is gone



- **Ignoring the learning curve:** expect a 2–4 week productivity dip after any workflow change

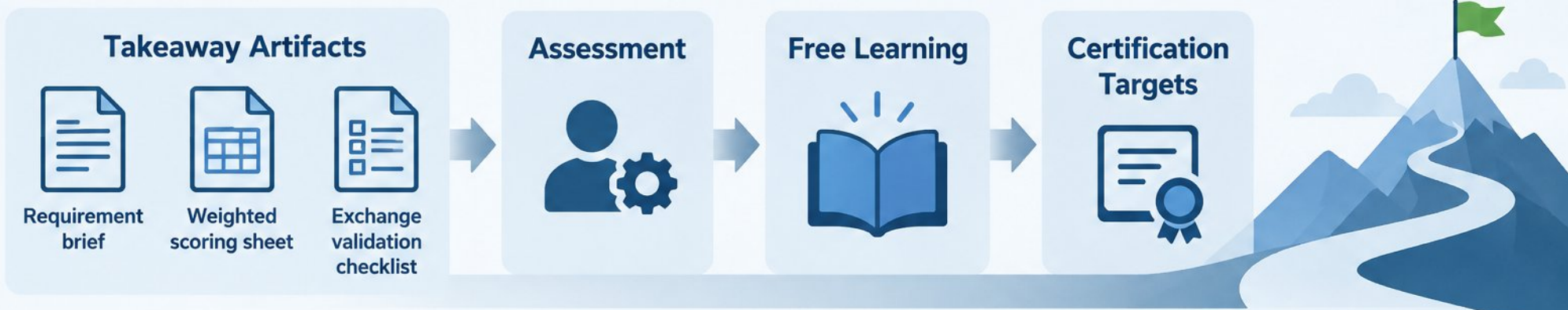


- **Hidden costs:** hardware, add-ons, cloud storage, certification fees, plus ~20% implementation contingency



- **Versioning mistakes:** moving files manually breaks references; editing exports as masters; silent unit errors

Your Next Steps: Templates, Assessment, and Learning Paths



Three takeaway artifacts

Three takeaway artifacts: requirement brief, weighted scoring sheet, exchange validation checklist



Assessment

Assessment: choose a tool from a stated brief, justify with scored evidence, define workflow checks



Free learning

Free learning: MySolidWorks (400+ lessons, free since July 2026), Onshape Learning Center, Siemens Xcelerator Academy, Autodesk Learning, Bentley Learn



Certification targets

Certification targets: CSWA/CSWP, Certified Onshape Associate, Siemens Design Associate, Creo Associate, Autodesk certification



Recap and verify

Recap the three pillars — requirements, selection, workflow — and verify current pricing and education terms before committing

BUILD
SKILLS
CHOOSE
WITH CONFIDENCE
GO FURTHER

PersonWise.

PersonWise • AI digital-human course platform



Scan the code or click anywhere to watch this course live, with voice Q&A

personwise.ai/t/9c1c5e7a/public