MechPart Pro

B2B Precision Manufacturing · Technical White Paper

PROCESS SELECTION

CNC vs. Additive Manufacturing: When to Use Which

A decision framework for choosing between subtractive and additive processes — tolerance, surface finish, materials, geometry, cost and volume, with a side-by-side comparison.

What's inside

1. Two ways to make a part

CNC machining removes material from a solid block or bar with rotating tools, guided by a CAD model. Additive manufacturing (3D printing) builds a part up layer by layer. Neither is universally better; each wins for particular combinations of geometry, tolerance, material and volume. Choosing well saves cost and lead time.

This paper gives a practical framework rather than a verdict, because the right answer depends on your part.

2. The deciding factors

Factor	CNC machining	Additive (metal/polymer)
Tolerance	Tight (to +/-0.005 mm)	Looser (~+/-0.1 mm typical)
Surface finish	Smooth as-machined	Layered; usually needs finishing
Materials	Full metal & plastic range	Limited qualified set
Geometry	Tool-access limited	Internal channels, lattices, organic shapes
Unit cost low volume	Higher (setup, fixturing)	Lower (no tooling)
Unit cost higher volume	Falls with quantity	Stays roughly flat
Material properties	Wrought, fully dense	Process-dependent; may need HIP

Values are typical guidance; exact capability depends on machine, material and part.

3. A simple decision framework

Choose CNC when

- The part needs tight tolerances or a fine as-machined finish.
- It must be made from a specific wrought alloy with guaranteed properties.
- Geometry is prismatic and tool-accessible.

- You are moving toward production volumes where unit cost matters.

Choose additive when

- Geometry is impossible or wasteful to machine — internal channels, lattices, conformal cooling.
- You need parts in days with no tooling, for early prototypes or one-offs.
- Light-weighting through topology optimisation outweighs tolerance needs.
- Volumes are low and likely to stay low.

Use both — the hybrid route

Many demanding parts are printed near-net then CNC-finished on critical interfaces, combining additive's geometric freedom with machining's tolerance and finish. This is common for aerospace brackets and medical implants.

4. Cost and lead time over the life cycle

Additive's no-tooling advantage makes it cheapest for the first few parts; CNC's unit cost falls with quantity and overtakes additive as volumes rise. For prototypes, print or machine depending on tolerance; for bridge production, compare both; for series production of precision parts, CNC (or molding/casting) usually wins on cost-per-part.

MechPart Pro runs both subtractive and additive processes and finishes printed parts on our CNC cells. Upload your model at mechpart.io/?page=quote and we will advise the most cost-effective route for your tolerance, material and volume — free, within 24 hours.