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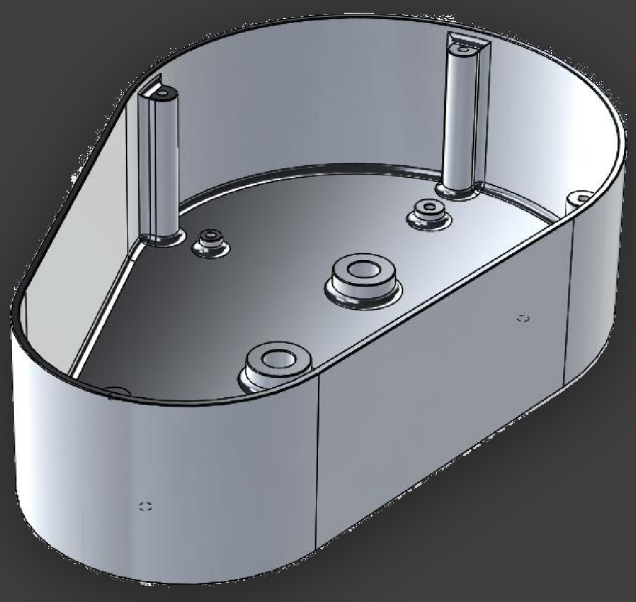
CASE STUDY · INDUSTRIAL

# GEARBOX HOUSING DFM REVIEW

AGENTIC DESIGN-FOR-MANUFACTURING
WITH NEXUS AND SOLIDWORKS

**Tools** Nexus · SolidWorks
**Outcome** 7 issues detected and resolved · 2–3 hrs saved · $140 saved per part



# WHAT'S INSIDE

A walk-through of how Nexus ran a design-for-manufacturing audit on a machined 6061-T6 gearbox housing in SolidWorks, independently matching an experienced engineer's findings, then updating the CAD model itself. What the agent caught on its own, and where the engineer steered.

**Summary** P. 03
Nexus conducted a DFM study, modified CAD, saved $140/part and 60% of the engineer's time.

**Problem** P. 03
A precision part where 96% is machined away and reviewing the design is slow, senior-level work.

**Methodology** P. 04
How Nexus reviewed the part, provided recommendations, and implemented the design changes the engineer selected.

**Results** P. 05
The housing design, before and after the DFM review.

**Agent Design Input** P. 06
Where the value compounds, the savings at volume, and the agent's interpretation of the design.

**Try Nexus** P. 07
How to bring the same workflow to your own DFM and CAD studies.

# SUMMARY

## Nexus conducted a full DFM review of a gearbox housing and implemented design updates directly in SolidWorks.

Nexus worked with the engineer in SolidWorks to audit a machined 6061-T6 gearbox housing, flagged **7 issues** an experienced engineer would raise, then made every approved change in the model. Together with Nexus, the engineer saved **$140 per part** and **60% of engineering time** on this study.

**60%**
ENGINEERING TIME SAVED

**$140**
MACHINING & SCRAP COST SAVED · PER PART

**7**
DFM ISSUES IDENTIFIED

Time and cost are modeled engineering estimates (a junior-engineer workflow with senior review).

# PROBLEM

A gearbox housing has to hold bearing bores in precise alignment. As drawn, this particular design is expensive to manufacture, and identifying where cost can be reduced typically requires a senior engineer to conduct a design review.

01 **High manufacturing expense**

About 96% of the starting block is machined off, over thin walls three inches deep that are slow to cut and prone to distortion, leading to increased manufacturing costs.

02 **Expert work, done manually**

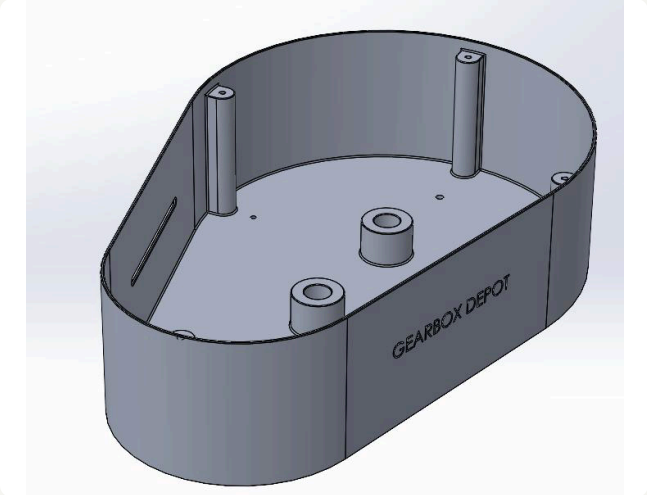
A thorough manufacturing pass across setups, tooling, tolerances and feature geometry is senior-engineer work. Each approved change is then made in the CAD model manually.

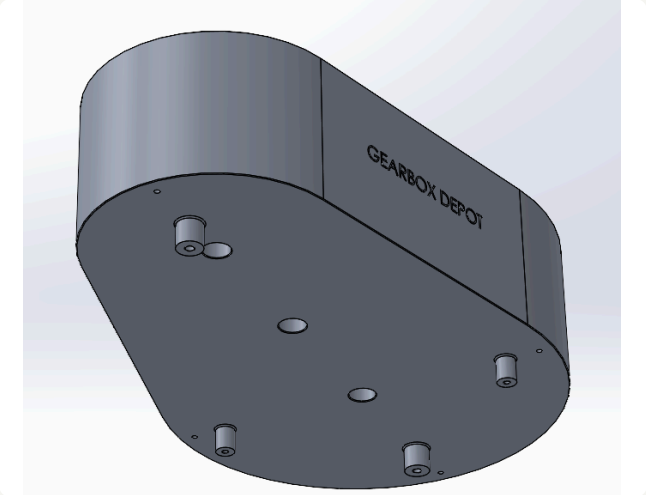
+ **Benefit to engineer**

Hand the design review of the part to the agent and it runs the first-pass audit at senior level, ranks the fixes by cost impact, and makes the design changes in the model following engineer approval. The engineer collaborates to judge the trade-offs and own the final review.

# METHODOLOGY

The engineer briefed Nexus on the housing's function, material (6061-T6) and process (CNC from billet), and objective to review the design. Nexus returned a prioritized list of issues and a proposed fix. The engineer reviewed and selected which design changes to make, and Nexus applied the design changes to the CAD model directly in SolidWorks, one at a time. Nexus proposed and the engineer confirmed.




AS-MODELED HOUSING (INTERIOR AND UNDERSIDE) · 6061-T6 · 238 CM³ FINISHED · 3 BEARING BORES · 4 COVER STANDOFFS · 4 BOTTOM STANDOFFS · SIDE SLOT

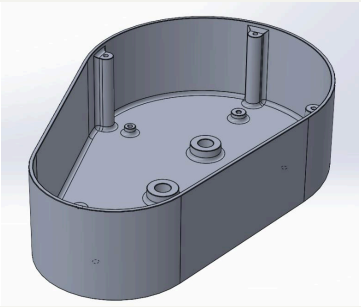
PRIORITIZED DFM FINDINGS **NEXUS-IDENTIFIED · ENGINEER-REVIEWED**

| PRIORITY | MANUFACTURING ISSUE | RECOMMENDED CHANGE |
|---|---|---|
| P1 | 96% material removed from solid billet | Near-net cast blank at volume; CNC only functional faces |
| P1 | 1/16-in walls, 3-in-deep pocket (48:1) | Thicken walls to ≥0.125 in |
| P1 | 4–5 setups; features on 4+ faces | Consolidate setups; drop the slot and engraving |
| P2 | Three tall island bearing bosses | Reduce boss height; blend into the floor/wall |
| P2 | Non-standard bearing bore (Ø0.523 in) | Resize to Ø0.500 in with an H7 seat |
| P3 | Small 0.030-in fillet radii | Open radii to 0.125 in |
| P3 | Mixed #6-32 / #10-32 threads | Standardize threads to #10-32 |

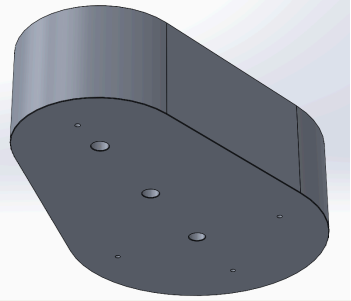
# RESULTS

| FEATURE | BEFORE | AFTER | MANUFACTURABILITY GAIN |
|---|---|---|---|
| **Wall thickness** | 0.0625 in (1/16″) | 0.125 in | **Heavier, faster passes; stiffer housing** |
| **Corner & fillet radii** | 0.030 in | 0.125 in | **Larger standard end-mills; stronger corners** |
| **Bearing bore** | Ø0.523 in (non-standard) | Ø0.500 in (H7 seat) | **Standard reamer & off-the-shelf bearings** |
| **Bearing-boss height** | 0.75 in | 0.375 in | **Shorter tools, less island clearing** |
| **Bottom standoffs** | Protruding below base | Re-oriented inside; base planar | **Underside finishes in one facing pass** |
| **Tapped holes** | #6-32 & #10-32, through-all | #10-32, blind at 0.380 in | **Fewer tap changes; simpler inventory** |
| **Side slot & engraving** | Curved wall / 0.030-in cut | Removed | **Fewer setups; a machining op eliminated** |

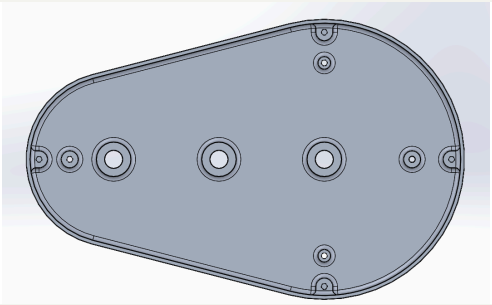
Nexus modified the CAD model in SolidWorks once the engineer approved Nexus' proposed design changes.



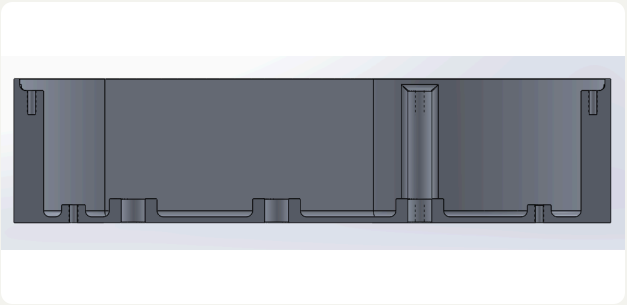
**Updated Housing Design**



**Reoriented Standoffs**



**Increased Wall Thickness & Radii**



**Reduced Boss Height & Thread Depth**

# AGENT DESIGN INPUT

This exercise tested whether an agent could do the senior-level part of a DFM and the corresponding design changes. The design changes Nexus made reduced machining and scrap costs by about **$140 per part**.

### + Where the value compounds

The senior-level DFM review that used to gate every production release is now a repeatable step. Now this workflow lives in Nexus: reading the part, prioritizing the fixes and editing the model, running the same review on the next housing design will be faster.

ESTIMATED COST SAVINGS AT VOLUME

| VOLUME | LARGEST SAVINGS OPPORTUNITY | ESTIMATED TOTAL SAVINGS |
|---|---|---|
| Prototype (10 pcs) | Machining & scrap | $780–1,400 |
| Low production (100 pcs) | Tooling standardization | $8,000–14,000 |
| Production (500+ pcs) | Near-net casting vs machining | $50,000+ · per-part cost down 40–60% |

### + Understands design principles

Nexus laid out what governs a good housing (bore alignment, center-distance control, datum strategy, stiffness) and reviewed against those principles.

### $ Reduced manufacturing costs

Larger fillets, fewer setups, a standard bore and threads, thicker walls and simpler underside bosses eliminate about $140 in recurring machining and scrap cost from every gearbox housing.

### → The engineer’s next move

The engineer conducts a final DFM review of the Nexus-updated model, confirming the engineering intent is intact and no critical feature or function was lost, and makes a final decision on whether to proceed with near-net casting for volume production, per the agent’s recommendation. From there, the housing is ready for manufacturing.

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# Think through > click through. Let Nexus handle the rest.

YOUR AI AGENT FOR ENGINEERING WORKFLOWS

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