

Garmin Design Assessment



## *Cleared for Redesign*

# *Improving EIS Readability for Novice Pilots Through Human Factors Design*

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*Design Validation Through Pilot Feedback*

Alex J. Lisko, M.S. | March 24, 2026

## The Task

Cessna 172S

**Redesign the Engine Indicating System (EIS)**

# Research process overview





# Heuristic Analysis

## STEP 01

# Heuristic analysis — Garmin G1000 EIS

*Nielsen's 10 Usability Heuristics applied to the existing system*

Heuristic	Violation in G1000 EIS	Severity
<b>H1 — Visibility of system status</b>	No at-a-glance state cue; CHT/EGT buried in sub-menus	High

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<b>H5 — Error prevention</b>	No proactive alert before parameters reach critical threshold	High
<b>H8 — Aesthetic &amp; minimalist design</b>	Equal visual weight across all parameters creates clutter	Med
<b>H3 — User control &amp; freedom</b>	Limited ability to reorder or surface priority parameters	Low



# Competitive Benchmarking

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G1000	Modern Avionics
 <p><b>Integrated</b> Tightly integrated</p>	 <p><b>Modular</b> Modular and customizable</p>
 <p><b>Knob-driven</b> Relies on knobs and buttons</p>	 <p><b>Touch + Hybrid</b> Uses touch &amp; hybrid controls</p>
 <p><b>Premium Standard</b> Dominates training standard</p>	 <p><b>Feature-driven</b> Compete on cost and innovation</p>



# Pilot Survey

## STEP 03

# Pilot survey — what the data uncovered

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**83%**

Missed a parameter

**4.8/5**

Color coding demand

**100%**

Reference RPM

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### What the survey uncovered



**Color is not optional**



**Workload breaks the display**



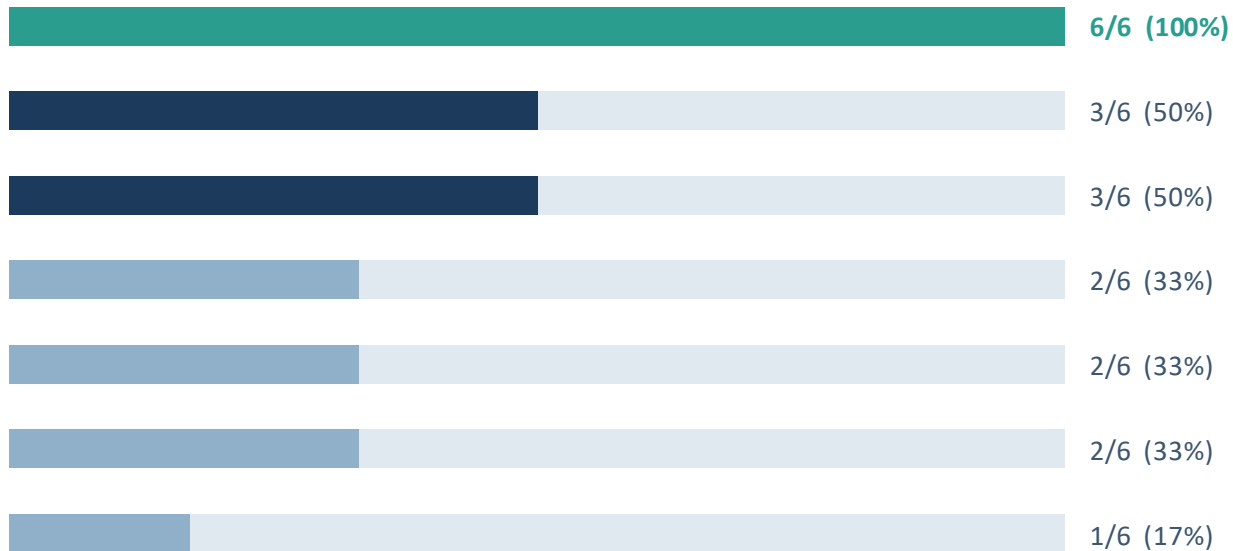
**Proactive alerting is absent**



**Hierarchy determines safety**

# PARAMETER PRIORITY What Pilots Actually Monitor

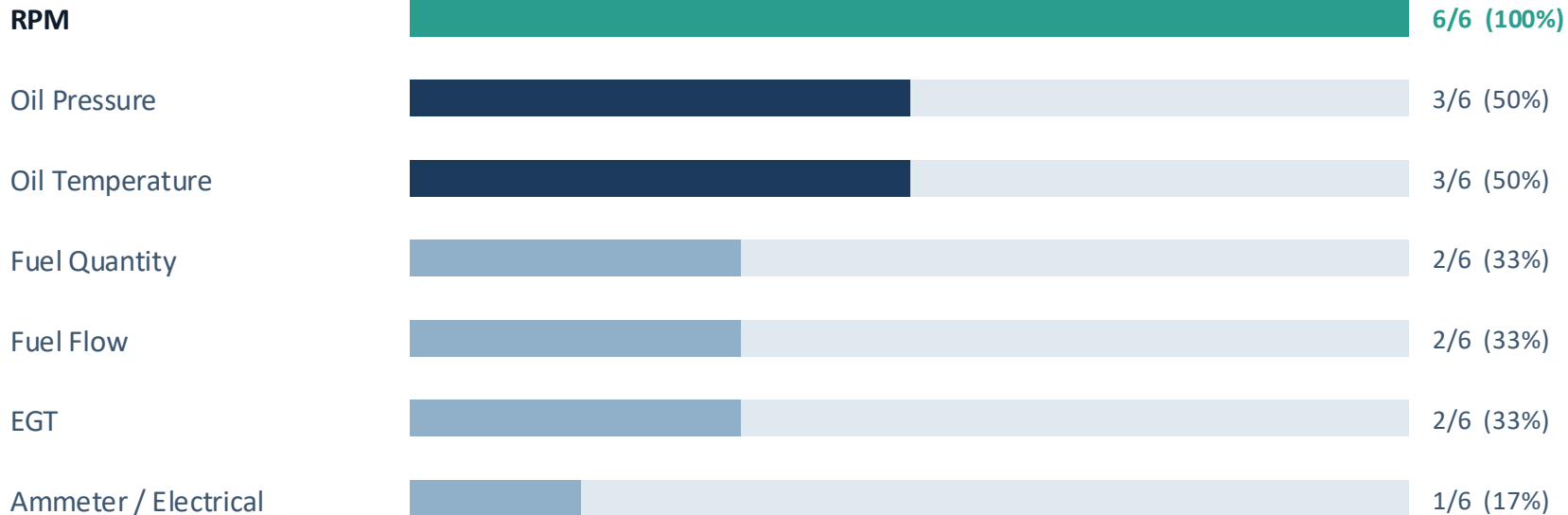
*% of pilots referencing each parameter*



Design implication: RPM is universal (100%). Oil Pressure & Temp are referenced by experienced pilots. Position the top 3 in prime scan zone.

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**Color coding (normal / caution / warning)**



4.8

**Clear visual alerts for abnormal readings**



4.7

Simplified scan / consolidated display



4.5

Trend monitoring (gradual changes)



3.7

Data logging / post-flight review



3.2

Top 2 findings directly validate core design decisions — color-coded ranges and proactive alerting are strongly supported by pilots of all experience levels.

## VOICES FROM THE COCKPIT

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*"Round gauges with a needle display + a number readout as found on modern part 25 airliners would be welcomed in GA. Digital displays preferred to z parallax error."*

ATP / Airline Pilot · MGL Blaze · 500–1,500 hrs



*"CHT readings can be erratic."*

Commercial Pilot · Garmin G1000 · 500–1,500 hrs



*"I would prefer more digital displays."*

Student Pilot · Garmin G1000 · Under 100 hrs



*"No data logging for mechanics to review."*

ATP / Airline Pilot · MGL Blaze · 500–1,500 hrs

# Design process overview

01



Defining  
Constraints



02



Early Concepts  
"Picasso"



03



Figma  
prototype



04



Design  
rationale

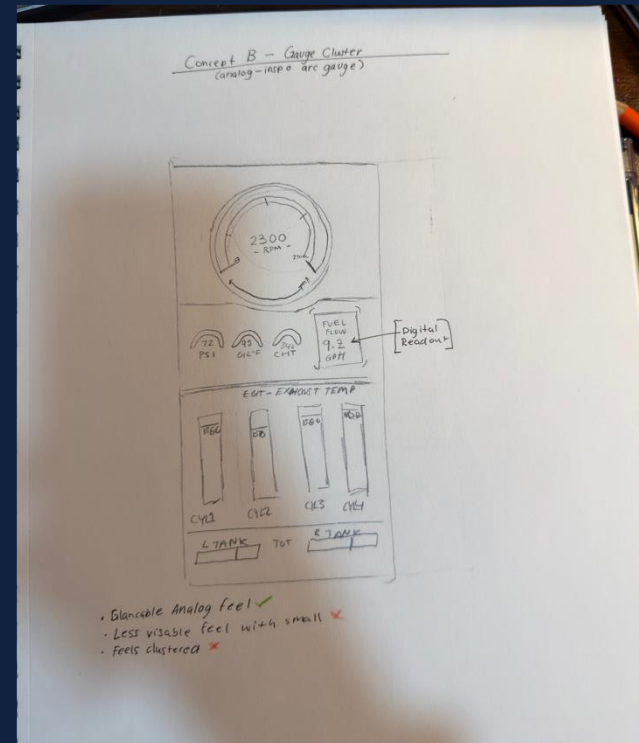
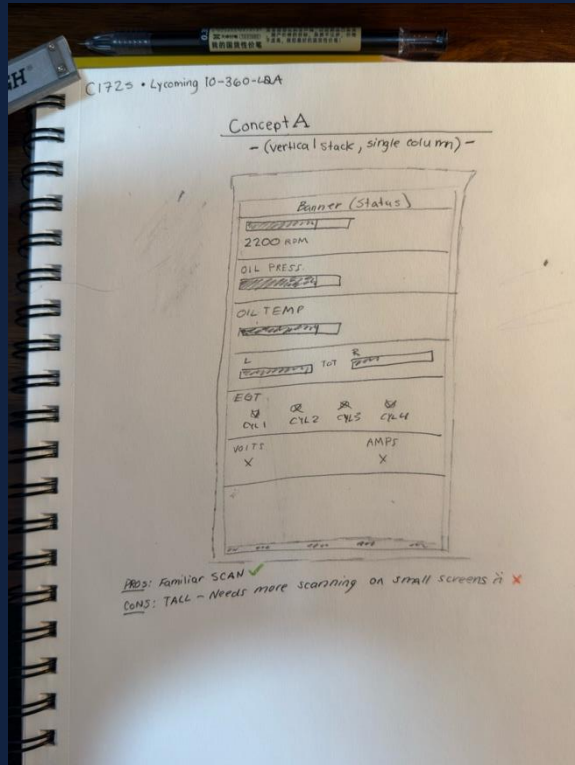


Cessna C172S

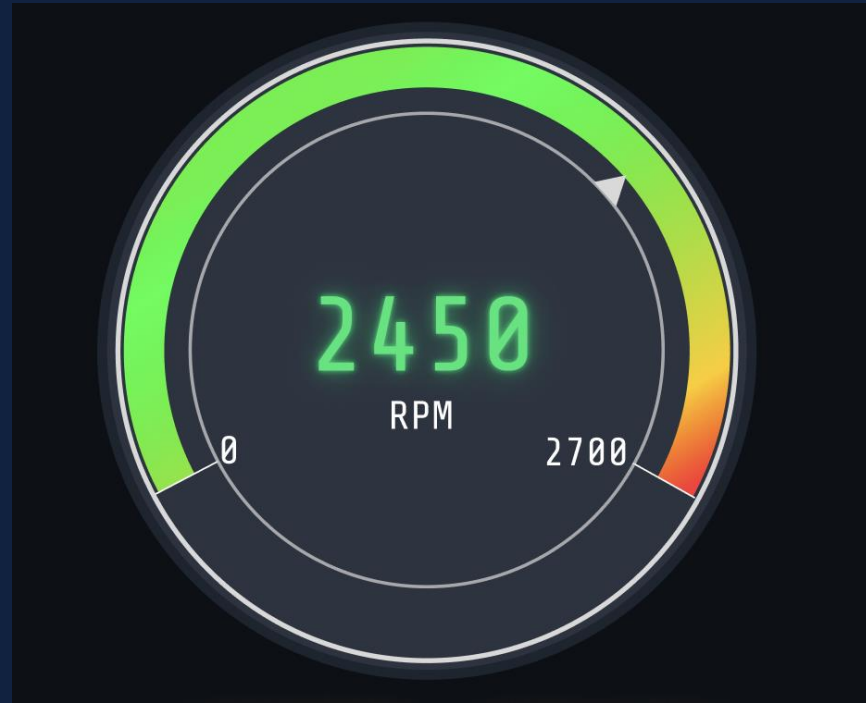
# Instrument Design and Style Guide

G1000

# Sketchbook Designs



# RPM Gauge Design



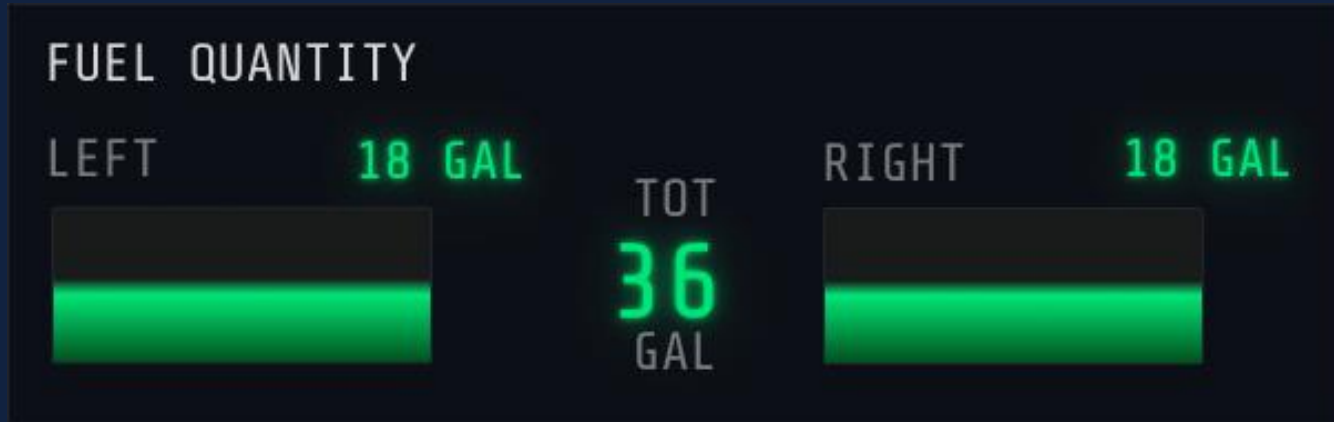
# Alert Module Design



# Warning State Design



# Fuel Gauge Design



# Multi-Cylinder Data Design

EGT (°F)

CYL 1  
1480°F

CYL 2  
1400°F

CYL 3  
1390°F

CYL 4  
1410°F

# Action Guidance Design

## IMMEDIATE ACTION - OIL PRESSURE

1. Reduce power immediately
2. Prepare precautionary landing
3. Monitor oil temp closely
4. Declare emergency if needed

# Nominal State

Green arc fills



# Nominal State

Green arc fills



Primary scan zone layout



# Nominal State

Green arc fills



Primary scan zone layout



No visual noise



# Nominal State

Green arc fills



Primary scan zone layout



No visual noise



High-contrast numerics



# Caution State



## Visual-only alert



# Caution State



Visual-only alert



Targeted emphasis



# Caution State



Visual-only alert



Targeted emphasis



Trend arrow indicator



# Caution State



Visual-only alert



Targeted emphasis



Trend arrow indicator



Amber — not red



# Warning State

## ✘ Full-width warning banner



# Warning State

✘ Full-width warning banner

👁️ Flashing red readout



# Warning State

✘ Full-width warning banner

👁️ Flashing red readout

🕒 Secondary params dimmed



# Warning State

✘ Full-width warning banner

👁️ Flashing red readout

🕒 Secondary params dimmed

⚠️ Red used exclusively here



CONCLUSION

**Design grounded  
in evidence.**

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Heuristic analysis identified 4 high-severity violations in the G1000

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- Pilot survey confirmed the problem
- Three-state design
- Every annotation links to a Nielsen heuristic

# Where I Used my Human Factors Training



Circular arc gauges support trend monitoring

H1 · H6



Rectangular alert modules demand attention fast

H1 · H5



Warning state must remove everything except the problem

H8 · H4



Horizontal bars eliminate mental math for fuel

H6 · H8



Multi-cylinder EGT needs structure, not just data

H4 · H6



Action guidance reduces workload at peak stress

H5 · H9

## CONCLUSION

# Key takeaways

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01

**The display is the problem, not the pilot**

02

**Color, hierarchy, and alerting are inseparable**

03

**Heuristics make rationale defensible**

04

**Pilot feedback validates the direction**

## Next Steps...

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Qualitative pilot interviews



Deeper competitive benchmarking



Quantitative usability metrics

THANK YOU

Good design earns  
the pilot's trust.

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