

ENGINEERING SPECIFICATION DOCUMENT

1991 Hydrostream AE-21 Full Structural Rebuild Project



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1 Structural Inspection Requirements

A complete hull, deck, and internal structure inspection is required prior to teardown. The 1991 Hydrostream AE-21 is a tunnel-vee hull with cored construction, which significantly affects repair methodology.

1.1 Exterior Hull Inspection

- Inspect gelcoat for cracks, blistering, and pad impact marks.
- Identify delamination around chines and strakes.
- Check transom for flexing or stress fractures around mounting holes.

1.2 Interior and Core Inspection

- Tap-test interior and floor for dull thuds indicating core separation.
- Moisture test stringers, transom, and floor structure.
- Identify soft spots or flexing panels.

1.3 Findings

Rot is confirmed in floor, stringers, and hull core. A full gut and rebuild is required.

1.4 Cost Summary

Item	DIY Cost (CAD)	Labour Cost (CAD)
Basic inspection tools (light, hammer, meter)	\$0-\$150	–
Professional survey (optional)	–	\$300-\$600
Section subtotal	\$0-\$150	\$300-\$600

1.5 Timeline

For a normal DIY builder:

- Inspection and documentation: 1–2 days (4–8 hours).

2 Teardown and Removal Requirements

2.1 Interior Removal

- Remove seats, carpet/EVA flooring, sideboards, and consoles.
- Remove fuel tank, lines, pumps, wiring, and speakers.

2.2 Structural Removal

- Cut and extract the entire floor.
- Remove waterlogged flotation foam.
- Remove stringers, bulkheads, and rotted core.
- Grind inner hull back to clean laminate.

2.3 Cost Summary

Item	DIY Cost (CAD)	Labour Cost (CAD)
Consumables (discs, blades, PPE, bags)	\$80–\$150	–
Teardown and grinding labour	–	\$800–\$1,800
Disposal fees (dump runs)	\$0–\$100	\$0–\$100
Section subtotal	\$80–\$250	\$800–\$1,900

2.4 Timeline

- DIY: 1–3 weeks (15–30 hours) depending on tools and experience.

3 Hull Core Replacement (Tunnel Hull)

The AE–21’s tunnel hull requires curved structural members. Core replacement must match factory geometry.

3.1 CAD Template Requirements

- Digital templates recommended to avoid wasted material.
- Required for curved tunnel walls, stringers, and floor transitions.
- Ensures proper bonding surface and hull conformity.

3.2 Core Material Options

- Marine-grade plywood (1/2”–3/4”).
- Coosa composite board (20/26 lb density).
- End-grain balsa (original Hydrostream configuration).

3.3 Lamination Schedule

- Epoxy resin for all bonding.
- 1–2 layers chopped strand mat for transitions.
- 2–3 layers 1708 biaxial over all core and stringer surfaces.

3.4 Cost Summary

Item	DIY Cost (CAD)	Labour Cost (CAD)
Core removal and prep	Included in teardown	\$400–\$800
Marine plywood / Coosa	\$200–\$800	–
Epoxy resin (3–6 gal)	\$300–\$600	–
Fiberglass cloth (1708/CSM)	\$180–\$350	–
Core install laminating labour	–	\$800–\$1,800
Section subtotal	\$680–\$1,750	\$1,200–\$2,600

3.5 Timeline

- CAD templating and planning: 1 week (5–10 hours).
- Core fitment and bonding: 2–4 weeks (25–50 hours).

4 Stringers, Bulkheads, and Internal Structure

4.1 Stringer System Requirements

- Two main longitudinal stringers.
- Tunnel-hull intermediate stringers (curved).
- Transverse bulkheads for rigidity.
- Rear transom knees for engine torque.

4.2 Fabrication

- All wood epoxy-sealed prior to installation.
- Structural fillets along hull/stringer joints.
- Each stringer glassed with 2–3 layers of 1708.

4.3 Cost Summary

Item	DIY Cost (CAD)	Labour Cost (CAD)
Stringer/bulkhead materials	Included in core/ply	–
Additional epoxy and fillers	\$50–\$100	–
Fiberglass reinforcement	\$30–\$80	–
Stringer fabrication labour	–	\$600–\$1,400
Section subtotal	\$80–\$180	\$600–\$1,400

4.4 Timeline

- DIY: 2–3 weeks (20–35 hours) including fitting, filleting, and glassing.

5 Transom Rebuild Requirements

5.1 Transom Replacement

- Remove existing transom core.
- Replace with dual 3/4" marine ply or Coosa.
- Reinforce knees and tie into stringers.

5.2 Cost Summary

Item	DIY Cost (CAD)	Labour Cost (CAD)
Transom core material (ply/Coosa)	\$150–\$450	–
Epoxy and glass for transom	\$60–\$120	–
Transom removal and rebuild labour	–	\$600–\$1,500
Section subtotal	\$210–\$570	\$600–\$1,500

5.3 Timeline

- DIY: 1–2 weeks (15–25 hours) including cure times between steps.

6 Floor and Deck Boards

6.1 Floor Requirements

- 1/2"–3/4" marine ply floor.
- Epoxy-sealed and bonded to stringers.
- 2 layers 1708 on upper surface.

6.2 Deck Boards

- Custom side panels and deck plates.
- Vinyl or carpet finish.

6.3 Cost Summary

Item	DIY Cost (CAD)	Labour Cost (CAD)
Floor/deck plywood	\$150–\$250	–
Epoxy, glass, fasteners	\$80–\$150	–
Floor and deck install labour	–	\$600–\$1,200
Section subtotal	\$230–\$400	\$600–\$1,200

6.4 Timeline

- DIY: 1–2 weeks (15–25 hours).

7 Rewiring (Performed During Teardown)

The AE-21's original wiring is inconsistent and outdated. Rewiring must be done **while the hull is gutted** so wiring can be routed cleanly along new stringers with minimal clutter and proper serviceability.

7.1 Electrical Requirements

- Marine-grade tinned copper wire for all circuits.
- New fuse block and breakers sized to each load.
- New bilge pump and float switch.
- Heat-shrink connectors, marine-grade bus bars, and proper crimp tooling.

7.2 Wire Routing and Harness Layout

- Route main harness runs along the tops or sides of stringers, secured every 200–300 mm.
- Separate high-current power runs (battery, amplifier feeds) from low-level signal runs (audio RCA, sensor wiring) to avoid noise.
- Use rubber grommets or bulkhead fittings where wiring passes through bulkheads or deck panels.
- Implement drip loops so any water entering a loom falls away from connectors.
- Label all circuits and create a simple wiring diagram for future diagnostics.

7.3 Power Protection and Fusing

- Install a main fuse or breaker within 7" of the battery positive terminal.
- Size fuses according to conductor ampacity and device requirements (e.g., 40–60 A ANL fuse for audio amplifier feed).
- Use separate fused circuits for bilge pumps, navigation lights, accessories, and audio systems.
- Ensure all grounds return to a common bus or dedicated ground block to reduce electrical noise and ground loops.

7.4 Cost Summary

Item	DIY Cost (CAD)	Labour Cost (CAD)
Wire, connectors, hardware	\$80–\$150	–
Fuse block and switches	\$40–\$80	–
Bilge pump and float switch	\$50–\$120	–
Wiring design and installation labour	–	\$600–\$1,200
Section subtotal	\$170–\$350	\$600–\$1,200

7.5 Timeline

- DIY: 1–2 weeks (15–25 hours) including planning, routing, termination, and testing.

8 Audio System Installation

8.1 Components

- 2–4 marine 6.5” speakers.
- Bluetooth receiver/head unit or hidden receiver with wireless control.
- Optional marine amplifier for higher output and cleaner sound.

8.2 Speaker Location and Structural Assessment

- Select mounting locations in non-structural side panels or coamings, avoiding tunnel walls, primary bulkheads, and transom knees.
- Confirm sufficient backside air volume behind each speaker to avoid overly sealed cavities.
- Avoid locations where water spray or standing water can directly impact speaker cones or terminals.

8.3 Fiberglass Cutting and Reinforcement

- Create CAD or cardboard templates for the exact speaker cut-out diameter and screw pattern.
- Tape off cut areas to minimize gelcoat chipping and mark centers accurately.
- Cut openings undersize first, then finish to final diameter using a drum sander or rotary tool.
- Add 1–2 layers of 1708 biaxial around the backside of the cut-out to stiffen the panel.
- Bond backing rings (marine plywood or Coosa) to the backside with thickened epoxy where the panel is thin or flexible.

8.4 Custom Pods and Sideboard Integration

- Where curvature prevents flush mounting, build custom pods using foam or MDF forms glassed over with multiple layers of fiberglass.
- Integrate pods into custom sideboards: CNC- or hand-cut marine plywood panels that house speakers, cupholders, and storage pockets.
- Wrap sideboards in vinyl or EVA foam to match upholstery and flooring.
- Ensure all mounting screws fasten into reinforced structures (backing rings, sideboards, or brackets), not just thin fiberglass skins.

8.5 Power Draw and Electrical Integration

- Size speaker wire at a minimum of 16 AWG tinned marine wire; 14 AWG preferred for longer runs.
- Size amplifier power feed typically at 10–12 AWG depending on amplifier rating and length.
- Install an inline fuse (40–60 A typical) at the battery end of the amplifier power cable.

- Run audio signal cables away from high-current power cables to minimize noise.
- Ground amplifier and audio system at the same ground reference point as the main electrical system to prevent ground loops and alternator whine.

8.6 Acoustic and Environmental Considerations

- Use IP-rated marine speakers designed for UV and salt/marine environments.
- Install foam sealing rings between speaker flange and mounting surface for better acoustic seal and to prevent rattles.
- Optionally apply thin EVA or closed-cell foam behind panels to reduce panel resonance.
- Maintain drainage paths so pods or cavities do not trap water.

8.7 Cost Summary

Item	DIY Cost (CAD)	Labour Cost (CAD)
Speakers (2–4)	\$120–\$250	–
Bluetooth receiver / head unit	\$60–\$100	–
Marine amplifier (optional)	\$150–\$300	–
Additional fiberglass and backing materials	\$40–\$80	–
Misc. wiring, terminals (audio-specific)	\$40–\$80	–
Audio installation and fabrication labour	–	\$300–\$900
Section subtotal	\$410–\$810	\$300–\$900

8.8 Timeline

- DIY: 2–3 weekends (20–35 hours) including planning, cutting, glassing, wiring, and tuning.

9 Carpet / EVA Flooring

9.1 Flooring Options

- Marine carpet (20 oz).
- EVA foam / HydroTurf for performance non-slip.

9.2 Cost Summary

Item	DIY Cost (CAD)	Labour Cost (CAD)
Marine carpet	\$150–\$250	–
EVA / HydroTurf (optional upgrade)	\$250–\$450	–
Adhesives and rollers	\$30–\$50	–
Floor covering installation labour	–	\$300–\$700
Section subtotal	\$180–\$750	\$300–\$700

9.3 Timeline

- DIY: 1 weekend to 1 week (8–16 hours).

10 Custom Tarp / Cover System

10.1 Cover Requirements

- Custom-fit Sunbrella travel tarp.
- Optional snap-on cockpit cover.

10.2 Cost Summary

Item	DIY Cost (CAD)	Labour Cost (CAD)
Sunbrella or marine fabric	\$200–\$350	–
Snap hardware and tools	\$40–\$80	–
Professional tarp pattern and sewing	–	\$350–\$650
Section subtotal	\$240–\$430	\$350–\$650

10.3 Timeline

- DIY sewing: 1–2 weeks (10–20 hours).
- Professional shop: 1–3 weeks lead time.

11 Custom Upholstery and Interior Trim

11.1 Design Requirements

- Maintain vintage Hydrostream aesthetic.
- Use modern stitching patterns and high-grade materials.
- New custom design using CAD patterning rather than copying old, shrunken covers.

11.2 Material Requirements

- 28–32 oz UV-resistant marine vinyl.
- High-density marine foam.
- UV-resistant thread (V-92/V-138).
- Backer boards (marine ply or PVC).

11.3 Cost Summary

Item	DIY Cost (CAD)	Labour Cost (CAD)
Marine vinyl (6–10 yards)	\$120–\$250	–
Marine foam	\$60–\$140	–
Thread, welt, trim	\$20–\$50	–
Adhesive and staples	\$20–\$35	–
Backer boards	\$40–\$90	–
Professional seat pair labour	–	\$400–\$900
Rear bench labour	–	\$200–\$500
Side panel labour	–	\$120–\$250
Design / CAD surcharge	–	\$150–\$300
Section subtotal	\$260–\$565	\$870–\$1,950

11.4 Timeline

- DIY (if sewing yourself): 3–6 weeks (30–60 hours).
- Professional upholstery: 2–6 weeks shop time.

12 Professional Marina / Shop Cost Summary

12.1 Structural Labour

- Teardown, core, stringers, transom, floor: \$8,000–\$18,000 total.

12.2 Systems and Interior Labour

- Electrical and rewiring: \$600–\$1,200
- Flooring install: \$300–\$700
- Audio system install and fabrication: \$300–\$900
- Custom tarp fabrication: \$350–\$650
- Upholstery labour total: \$870–\$1,950

13 Project Timeline Summary

13.1 Section-by-Section DIY Time Estimates

For a normal person working evenings and weekends (roughly 8–15 hours per week):

Section	Hours (Approx.)	Typical Duration
Inspection	4–8	1–2 days
Teardown	15–30	1–3 weeks
Hull core replacement	30–60	3–6 weeks
Stringers and bulkheads	20–35	2–3 weeks
Transom rebuild	15–25	1–2 weeks
Floor and deck boards	15–25	1–2 weeks
Rewiring	15–25	1–2 weeks
Audio system (incl. fabrication)	20–35	2–3 weekends
Carpet / EVA flooring	8–16	1 weekend–1 week
Custom tarp (DIY)	10–20	1–2 weeks
Custom upholstery (DIY)	30–60	3–6 weeks
Total	167–314	Roughly 4–8+ months

13.2 Interpretation

- At 10 hours per week, 170–300 hours of work equates to roughly 4–8+ months.
- Working more aggressively (20+ hours/week) can compress the project into 2–4 months, but cure times and weather still apply.

14 Conclusion

The full restoration of the 1991 Hydrostream AE–21 requires a comprehensive structural, electrical, and cosmetic rebuild. Initial inspection confirms that the original core, stringers, and floor are compromised, making a complete gut and reconstruction mandatory for safe operation.

The tunnel-vee hull architecture demands CAD-assisted templates and custom fabrication to correctly follow the hull curvature while minimizing material waste. By using epoxy-based construction, biaxial fiberglass, and marine-grade or composite materials, the rebuilt structure will significantly exceed the durability of the original configuration.

Rewiring the boat while it is fully apart allows for a clean, logically routed harness that removes decades of patchwork and aftermarket modifications. Integrating the audio system, bilge, lighting, and accessories at this stage ensures reliability, serviceability, and a professional finish.

Custom interior components, including carpet or EVA flooring, sideboards, and fully redesigned upholstery, preserve the vintage Hydrostream aesthetic while modernizing comfort, materials, and visual quality. A custom tarp or cover protects the finished work and extends the service life of both structure and interior.

Overall, this specification provides a complete roadmap from gutted hull to fully restored, structurally sound, and visually refreshed AE–21. The end result is a vintage performance boat that has been engineered, rather than merely repaired, to deliver many more years of safe, high-speed use while maintaining the classic Hydrostream identity.