Part 07: Symmetrical High-Solidity Cruise Matching & Cascade Fluid Logic

1. Unified Airframe Geometry & Spatial Clearances

- **Total Structural Wingspan:** Locks in a highly portable 13.18-foot total span. This comprises two straight 6.59-foot outer panels joined to a 2.28-foot wide central fuselage bay.
- **Aerodynamic Frame Chord:** The main wings maintain a flat, uniform 2.2-foot chord width across their entire span, preventing localized lift drop-off or sudden stall vectors.
- **Central Cargo Fuselage:** Sized via a modified, blunted, and stacked AH 80-140 airfoil profile. It features an extruded 4-foot chord length by a 2.28-foot width block, yielding 13,474 cubic inches (7.79 cubic feet) of internal cavity space.
- **Self-Trimming Pitch Matrix:** Mounting the central fuselage airfoil completely upside down generates a passive positive pitching moment ($+C_{m}$). At a 7.4 to 8.78-degree cruise Angle of Attack (AOA), this positive torque perfectly counteracts the nose-down twisting force of the wings, achieving a net-moment coefficient of exactly 0.000 (-0.72 ft-lbs) referencing the root quarter-chord. This completely eliminates the weight, drag, and mechanical failure points of traditional tail booms, flaps, elevators, or canards.

2. High-Efficiency WingCrafter Cruise Parameters

- **Cruising Flight Envelope:** Operates at a stable 6,000-foot altitude baseline with an oncoming cruise velocity of 88 ft/sec (60 mph / 26.82 m/s).
- **Viscous Boundary Layer Physics:** Operates at a predictable Reynolds Number of 1,063,643. The factory-sealed, single-unit carbon fiber skin shell minimizes surface friction, maintaining an ultra-clean aerodynamic profile.
- **Aerodynamic Performance Balancing:** At an 8.78-degree root AOA, the wing area develops 225.26 lbs of total active lift, establishing perfect equilibrium with the aircraft's gross takeoff weight.
- **Drastic Drag Reduction:** Total profile frame drag plummets from 46.17 lbs down to a remarkably low 24.86 lbs (comprising 5.18 lbs of skin friction drag and 15.10 lbs of induced wingtip vortex drag), yielding a highly efficient Lift-to-Drag ratio (L/D) of 9.06.

3. JavaProp Cruising Fluid Dynamics & Torque Matching

- **Propulsion Footprint:** Flight control is managed entirely by exactly four wing-mounted 42-inch (1066.8 mm) high-solidity "spork" propellers. Pitch, roll, and yaw are governed purely by high-frequency micro-stepping hydrostatic shunting, leaving zero external moving flight surfaces.
- **Cruising Thrust Target:** Overcoming the 24.86 lb global drag wall requires a minor thrust output of only 6.22 lbs (27.64 Newtons) per propeller.
- **Propeller Shaft Kinematics:** To deliver 27.64 N of thrust against a 60 mph headwind, the 42-inch blades rotate at a relaxed speed of 1,672 RPM. The local blade stall drops to a flat 0.00%, maximizing cruise aerodynamic efficiency (η) at a clean 64.26%.

- **Aerodynamic Resistance Profile:** Slicing through the cruise air mass draws an exact rotational resistance torque of 7.953 Nm per hub, drawing a minor 1,392 Watts (1.39 kW) of mechanical power per blade motor.

4. Hydrostatic Drivetrain Gearing (Parker PGM 505-0090)

- **Motor Displacement Parameters:** Driven by aluminum Parker PGM 505-0090 fixed-displacement gear motors displacing exactly 9.0 cc/rev (0.55 in^3/rev).
- **Volumetric Flow Delivery:** Rotating a 9.0 cc motor at 1,672 RPM demands a localized flow rate of 15.05 Liters per minute per hub. Combined vehicle flow across all 4 active motors totals 60.20 L/min.
- **Ultra-Low Line Stress Threshold:** Converting the 7.953 Nm propeller torque across the 9.0 cc motor at 90% mechanical efficiency plummets the continuous cruising line pressure down to just 61.69 Bar (894.7 PSI).
- **Power Circuit Optimization:** Total fluid transmission power across the grid draws 6,190 Watts (6.19 kW) from the dual engine core. This consumes just 61.9% of your maximum 10,000-Watt power envelope, leaving a massive excess power safety margin.

5. Self-Regulating Cascade Spring Logic Matrix

- **The Energy Storing Driver:** The core engine modules maintain perfect kinetic balance across their cycles by forcing their internal 14.2-lb pure tungsten linear slugs to push directly against a high-pressure fluid wall inside the High-Pressure Accumulator (HPA) first, preventing any internal structural piston-slamming failures.
- **Takeoff Configuration (High Volume):** At 80 to 100 BPM takeoff speeds, the engine pumps a massive 81.84 L/min into the grid. This volumetric inundation floods the downstream Low-Pressure Accumulator (LPA), violently driving its internal piston backward until it pins solid against its maximum spring compression length. The LPA temporarily disappears from the circuit, allowing system line pressure to stack instantly back up into the HPA to hit its high-torque 2,800 PSI takeoff ceiling.
- **Cruise Configuration (Self-Actuating Cascade):** When transitioning to forward cruise, the engine drops into its pulse-skipping fuel-saving profile at an unhurried 58.8 BPM frequency. As volume drops to 60.20 L/min, the LPA internal spring naturally relaxes and un-pins. Fluid flows continuously from the engine, through the HPA buffer, and cascades straight into the input of the LPA. The LPA smoothly regulates and exhausts the oil to the wing motors at a low-stress, thermal-free 894.7 PSI threshold without requiring any electronic switching valves or software overhead.

6. Extended Tactical Mission Capability Ledger

- **Hourly Fuel Consumption Target:** Running at a relaxed 58.8 BPM cycle frequency draws a microscopic fuel burn rate of only 2.66 lbs of diesel per hour.
- **Rigid Operational Field Reserve:** Carves out a strict 12.0 lb fuel cushion. This is meticulously sized to secure 6 complete high-power vertical launches (1.52 lbs each) and 12 vertical pulse-skipped "Elevator Drop" landings (0.062 lbs each) under chaotic battlefield crosswinds.

- **Active Cruising Fuel Allocation:** Subtracting the 12.0 lb reserve from your 60.0 lb main fuel tank leaves an active cruising budget of exactly 48.0 lbs of liquid diesel.
- **Unmatched Stealth Airborne Endurance:** Dividing 48 lbs of fuel by the 2.66 lbs/hr burn rate mathematically secures an extraordinary 18.04 hours of continuous airborne endurance.
- **Total Strategic Operational Range:** Scurrying along at a steady 60 mph for 18.04 hours yields an absolute range boundary of 1,082.4 miles total, locking in a flawless tactical combat resupply radius of **541.2 miles straight out and 541.2 miles completely back to base on a single tank.**
