



TECHNICAL ADDENDA — Engineering Foundations and Analytical Validation

Supporting Documents for Structural, Aerodynamic and Performance Verification

The Eternaus program is supported by a set of technical addenda that complement the conceptual and structural description of the aircraft family. These documents provide analytical depth, independent validation, and engineering rigor to the super-rigid aerostatic architecture.

The addenda presented below consolidate:

- **external aerodynamic evaluation through Computational Fluid Dynamics (CFD)**
- **structural weight estimation and performance calculations for the Explorer H2**

Together, they form the technical backbone that supports the scalability, feasibility, and operational performance of the Eternaus platforms.

1. Aerodynamic Evaluation — CFD Analysis (Explorer Model)

BRENG Engenharia e Tecnologia — Report BRE-010925-AN-001-01

This addendum presents a complete aerodynamic assessment of the **Eternaus Explorer**, performed by **BRENG Engenharia e Tecnologia**, using advanced **Computational Fluid Dynamics (CFD)** simulations.

The study includes:

- external flow behavior
- pressure and velocity fields
- wake formation and boundary-layer behavior
- drag force and drag coefficient estimation
- comparison between analytical and numerical methods
- 2D and 3D simulation correlation
- power requirements and operational envelope

The CFD analysis validates the aerodynamic efficiency of the Explorer's elongated hull, confirming:

- **attached flow over most of the surface**
- **absence of major separation regions**



- **drag coefficient consistent with large aerostatic bodies (≈ 0.21)**
- **stable wake formation and predictable pressure recovery**

This document provides the first external aerodynamic certification-grade evaluation of the Eternaus concept and serves as a reference for scaling to larger models.

2. Structural Weight and Performance Calculation — Explorer H2

Detailed Engineering Analysis

This addendum presents the complete structural weight breakdown and performance estimation for the **Eternaus Explorer H2**, including:

- geometric parameters
- structural surface areas
- displaced volume
- maximum thrust
- aerodynamic power requirements
- friction and penetration drag models
- internal pressurization effects
- structural sizing of the central tube and toroidal rings
- material selection and stress margins
- hydrogen mass and buoyancy calculations
- payload and fuel allocation
- total structural mass and thrust-to-weight ratio

Key engineering highlights include:

- **central backbone tube pressurized at 2 kg/cm^2** , sized to transmit all propulsion forces purely through tension
- **toroidal rings pressurized at 2 kg/cm^2** , ensuring radial rigidity and shape retention
- **external hull designed for 420 mmca operating pressure**, with safety margins
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- **total structural mass $\approx 7,525$ kg**, leaving **6,706 kg** available for payload + fuel
- **maximum thrust 20,230 kg**, yielding a **weight-to-thrust ratio of 0.37**
- **power requirement curve proportional to v^3** , confirming ultra-low drag for an aircraft of this scale

This addendum provides the engineering foundation for the Explorer's structural feasibility and performance envelope.

(Detailed Structure Weight and Performance Calculation — Eternaus Explorer H2)

3. Purpose and Strategic Role of the Technical Addenda

These addenda serve three strategic functions within the Eternaus program:

3.1 Engineering Validation

They provide independent, quantitative verification of the structural and aerodynamic principles described in the main Technical chapter.

3.2 Scalability Framework

The Explorer model acts as a reference platform for scaling calculations to larger aircraft (Mercur, Hercules, Titan, Atlas).

3.3 Investor and Partner Confidence

They demonstrate that the Eternaus concept is not theoretical — it is supported by:

- certified engineering methodologies
- CFD simulations
- structural calculations
- material stress analysis
- performance modeling

This elevates the project to the level expected by aerospace partners, operators, and premium clients.

4. Included Addenda



The following documents are officially incorporated into the Eternaus Technical Dossier:

1. **BRE-010925-AN-001-01 — Aerodynamic Evaluation of the Explorer (CFD)**
2. **Detailed Structure Weight and Performance Calculation — Explorer H2**

Both documents are attached in full form part of the official engineering record of the Eternaus program.