BUTTERFLIES Project

Bio-Polymers & Additive Manufacturing

Newsletter I

The Algorithm That Picks the Perfect Glue

How a behind-the-scenes task is setting up smarter binder-jet printing with chitin.

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If you want to make binder-jet printing with chitin actually work at scale, you don't start with a machine—you start with a shared notebook. In BUTTERFLIES, that notebook is the *Digital Requirements Analysis* (DRA). It's the rulebook that says what every team logs (and how), which targets matter, and how those pieces flow into the "Digital Biosphere"—the project's AI-assisted brain for binder-jet optimization.

Why does that matter? Because binder-jetting lives or dies by the match between powder, binder, and settings. For BUTTERFLIES, the powder is chitin, a biodegradable polymer; the promise is low-heat processing and fast, complex shapes at low cost—appealing traits for healthcare products like orthoses. The catch? Performance hinges on the fit between powder, binder, and settings. Pick poorly, and you get fragile parts or wasteful reruns; pick well, and you get accurate parts with less energy and less trial-and-error. The DRA corrals these choices into a common language, so the project can learn from every print—cleanly, comparably, and fast.

What makes BUTTERFLIES Digital Biosphere a game changer

The Digital Biosphere isn't just another dashboard. It's where the agreed-upon data turns into actionable recommendations: which binder recipe and which settings to try next for chitin-based prints—ranked against the targets everyone signed up to at the start. Those targets are concrete for binder-jetting: ≤ 0.2 mm dimensional accuracy, Ra 1–5 µm after polishing, 60 splints in four days, and big cuts in energy and CO_2 (both −40%)—plus a bold goal to halve the number of experiments needed to get there. If delivered, that combination resets the economics and pace of process tuning in this space.

The reason it can work is unglamorous—and vital. DRA nails the basics: one table of process variables and ranges, one set of product quality attributes and KPIs, and one SOP for data capture that keeps names, units, timestamps, and versions consistent across sites. No "humidity" as a footnote in one lab and a number in another. No missing units. No rewiring later.

Why this groundwork matters: when the first print results arrive, WP5 can immediately train practical models—no data rescue missions, no renaming campaigns, no missing units. The platform can then rank promising binder + setting combinations against the same yardstick

everyone agreed on at the start, and show the trade-offs (accuracy, surface finish, time, energy) in a way operators can use on a real job.

The headline result of the DRA is not a printed part—yet. It's agreement. On what to measure, what to aim for, and how to speak the same language about quality. With that in place, the Digital Biosphere can do something refreshingly down-to-earth: help pick the optimal glue and the perfect printing settings, sooner and with less waste. That's how small, careful steps today translate into faster, cleaner binder-jet printing tomorrow.

Figure: The Digital Requirements Analysis (DRA) is crucial for the Digital Biosphere Platform to run, and is used to assess the technical and operational requirements of the platform.

