**Concurrent Design & Data Facility (CD2F): conceptualizing a next-generation CDF**

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1. **Introduction**

Concurrent Engineering has many benefits, with a factor of 4 reduction in time and 2 in cost for Phase 0 and A design reported at ESA’s ESTEC facility. CDF studies are also reputed for their high quality. Despite this, there is limited empirical evidence of better “design quality” – because this concept *itself* is ill-defined. Meanwhile, the *Internet of Things* & *Big Data* show how novel sensors & data bring pivotal transformation.

* 1. **Background: the Design Observatory**

A “Design Observatory” (DO) is a concept invented at Stanford, “as an integrated environment to observe, analyse, and intervene into design activity”, e.g. by ethnographers recording engineers designing [1]. It provides valuable empirical data to Design Research, allowing the improvement or validation of design methods, processes & tools. Indeed, to improve and sustain high levels of innovative design, we must effectively manage design performance, including creating tailored design processes, and well-performing tools, technology & team structures. This requires a fundamental understanding of design practices which currently does not exist [1]. Recently, many novel sensors and software can capture & display new design data during synchronous collaborative design, an approach validated in a new facility at MIT (Fig. 1) [2].

1. **Proposed concept: the Concurrent Design & Data Facility**

The Concurrent Design & Data Facility (CD2F**)** synergistically fuses the CDF & DO concepts into a highly innovative platform for both design, & design method advances. Limitations of each concept are curtailed: instrumented design allows the very first *rich* *empirical data* for evaluation of design tools & methods in a CDF, for iterative improvement. On the other hand, a CDF provides an ideal environment for observation – collocated, concurrent, transparent design – with many of the advantages of design ethnography, and outputting *real designs*. The latter’s value greatly reduce the data’s cost, and professionalize the process.



Figure 1: Instrumented Design Observatory concept, and captured data of process. Adapted from [2]

1. **Expected benefits & facility design**

The design methods employed will accumulate ever-more hard empirical data on their efficacy – and will be continuously improved using the design observation data. Design credibility will increase: for example, simple training or decision-making methods for design might be easily validated. R&D outputs will increase (double?) from *both* actual novel designs, *and* continuous design method testing. Requirements, and a conceptual design for the facility have been developed, for feedback from the community. Some key design choices are presented, including the amount & method of data capture, and sensor selection.

1. **References**

[1] Törlind, P., Sonalkar, N., Bergström, M., Blanco, E., Hicks, B., McAlpine, H.: Lessons Learned and Future Challenges for Design Observatory Research. In: 17th (ICED) International Conference on Engineering Design, vol. 2, pp. 371–382. Palo Alto, CA, USA (2009).

[2] Pelegrin, L., Moser, B., Wanaka, S., Chavy-Macdonald, M.A., Winder, I.: Field guide to interpreting engineering team design behavior with sensor data. In: CSD&M: Complex Systems Design & Management, pp. 303–218. Springer, 2019.