

Analysis Leading Design in Innovation

Tech Brief 190101 D



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January, 2019

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Abstract:

Innovation meets technological objectives by reducing costs, increasing performance, and expanding commercial opportunity. This tech brief provides a short discussion on how Analysis Leading Design (ALD) can facilitate innovation in actualizing these objectives.

Background:

Due to the symmetry observed in nature, innovations create obsolescence as well as expand commercial opportunity. The increased economic activity created by innovation, however, tends to more than compensate for losses associated with it. Examples abound over the last 150 years in transportation, communication, and agriculture.

Innovations can be categorized into strategic and tactical. Strategic innovations are ideas which open completely new means of achieving a desired end. Tactical innovations direct a process to identify and implement both viable and desirable courses of action resulting in the successful implantation of ideas. In discussing Analysis Leading Design (ALD) for innovation, tactical innovation is what is being considered.

The value ALD creates comes from empowering engineers and project managers to identify as early as possible the impact of constraints and competing objectives on design alternatives. This reduces noise in the information flow during the decision-making process requiring less time and resources for implementing solutions.

Innovation:

Ideas which expand commercial opportunity are oftentimes novel but they are always aligned with reality. Brainstorming is a productive activity in generating ideas but analysis is required for ideas to be implemented into actual solutions.

Typically, analysis is considered a de-constructive process whereby the individual elements of a system

are evaluated within a whole. Analysis Leading Design (ALD), however, is a top down process whereby First Principles governing the system are accounted for using minimalistic representations of system particulars and the whole is considered before the individual elements. This approach enables engineers to see early in the design process the solution space created by both financial and physical constraints.

Analysis Leads Design (ALD):

This top down process provides warrants for high confidence levels in the certainty of decisions made early in the design process. As greater precision is required to ensure compliance with performance objectives, ALD also creates independent predictive models as a means of cross checking the predictive power of other data sources. This eliminates potential extraneous noise in decision making.

Three universals are present in ALD models. They are:

- spatial/temporal relationships
- operating potentials
- continuum for cause and effect.

These universals are present in tangible designs such as, structural, electronic, thermal systems, etc. as well as intangible systems such as communication and financial. For a structural system, these three universals translate into *geometry, loads, and materials*.

The links below provides an example of how ALD was used in facilitating innovation in the design of a stealth Navy power generator system:

[ATG Isolation System Design - ASME GT2012-68021](#)

[Storyboard of ATG Isolation System Design](#)

The ASME paper documents how ALD efficiently directed the design process to a successful system solution in a technologically challenging project. The storyboard is a consolidation of the narrative. The top-down approach guided the decision-making process and provided the means of validating the models, leading both design and testing resulting in a design which met performance requirements within cost and schedule.