

T&E to Meet the Pace of Need...

... Will Require a Disruptive Transformation!

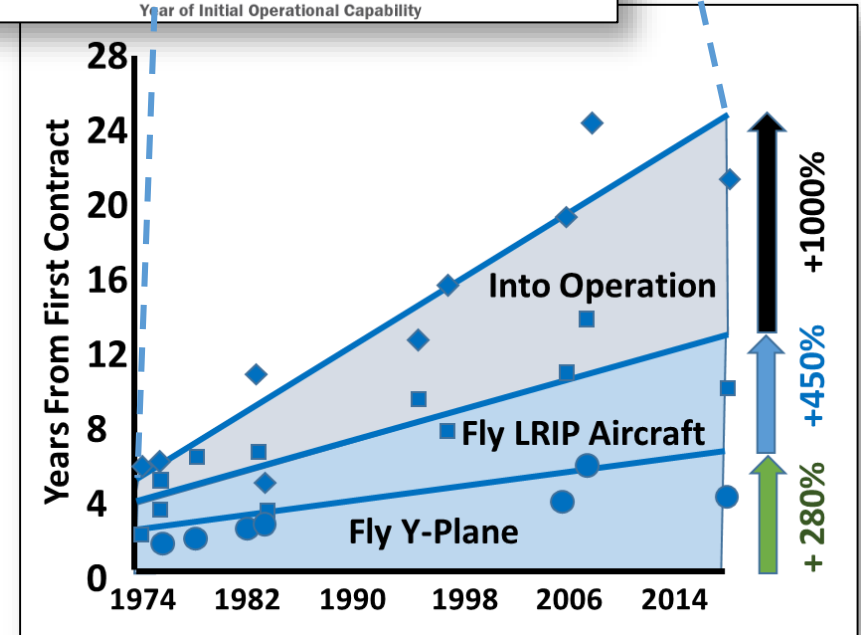
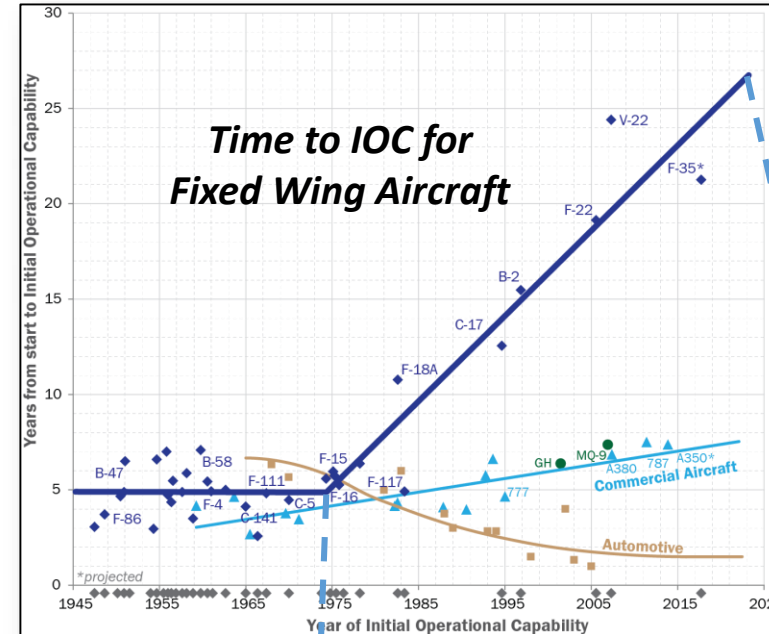
Dr Ed Kraft

Associate Executive Director for Research

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NDIA 33rd Annual National T&E Conference

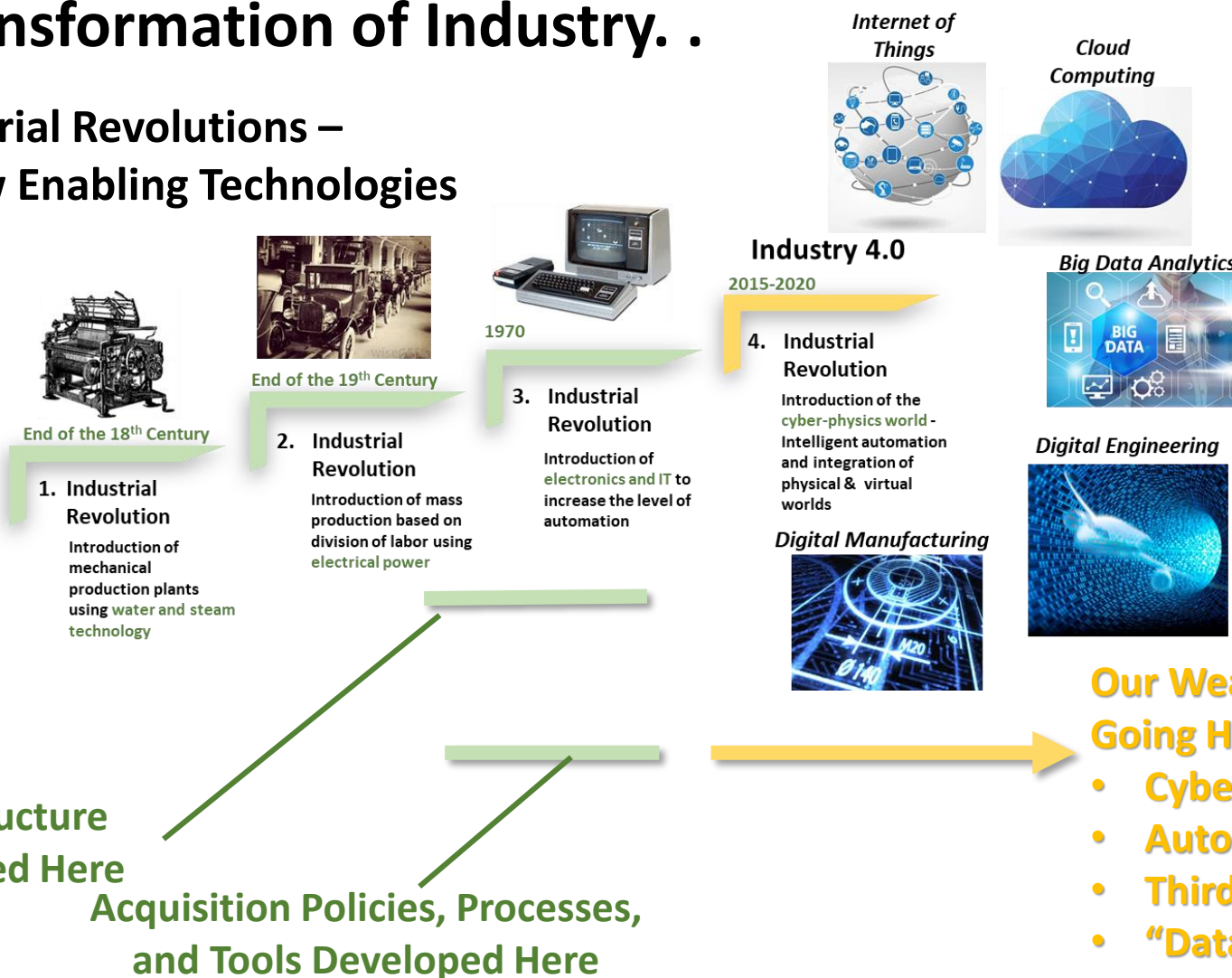
Solomon Island, Maryland



Source: Dan Patt, DARPA

The Global Digital Revolution – a Disruptive Transformation of Industry. .

History of Industrial Revolutions – Always Driven By New Enabling Technologies



Most T&E Infrastructure and Tools Developed Here

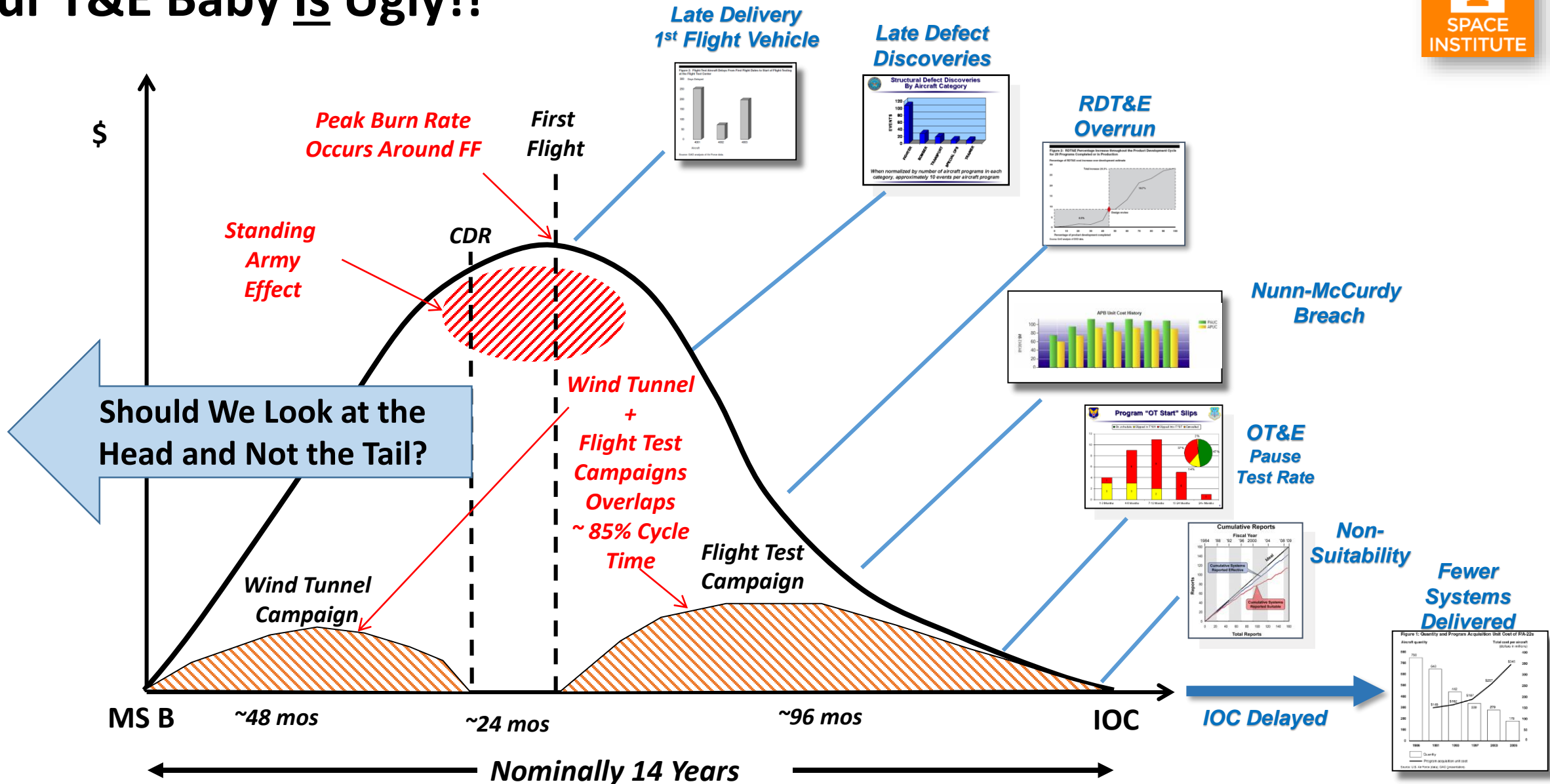
Acquisition Policies, Processes, and Tools Developed Here

Our Weapon Systems Are Going Here

- **Cyber Warfare**
- **Autonomy**
- **Third Pivot**
- **“Data as a Weapon”**

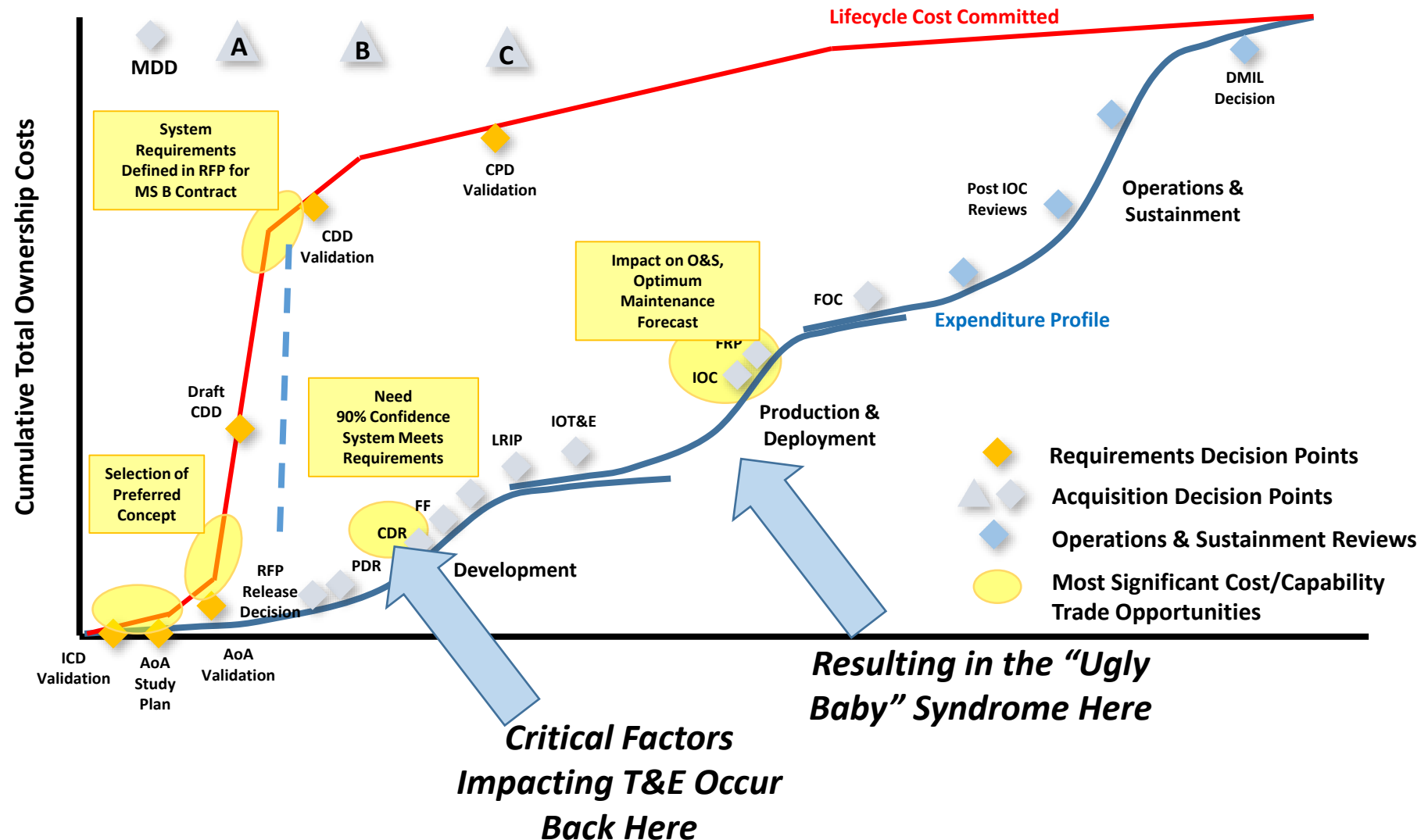
The Digital Revolution is Already Here . . . And T&E is Falling Behind

Our T&E Baby Is Ugly!!



...Or Are We Holding It Upside Down and Backwards?

Decision Framework for Defense Systems



Digital Transformation and T&E



Shifting from linear, document-centric system lifecycle process towards a dynamic, connected, digital model-centric ecosystem enables disruptive transformations including

- **Digital TEMP** – dynamically coupled to requirements, reduce preparation time, employ model based-engineering and uncertainty quantification to develop an optimum T&E campaign, minimize defects –set stage for the digital revolution
- **Validated Digital Surrogates** Expanding STAT to elevate T&E as key to the validation of an Authoritative Digital Surrogate Truth Source vice just calibrating a model
- **Uncertainty Quantification** Employ digitally captured quantified epistemic and aleatory uncertainties for MRTFB test capabilities to allocate uncertainty reduction budgets to particular tests – learning when you have to iterate the design or move on to the next level of modeling or testing
- **Test Digital Twin** – by test asset, use a real-time digital surrogate to assess the system state, early indication of potential aberrant behavior, and ability to forecast the next best data point even during the sortie
- **Digital Critical Decision Points** – Use Authoritative Digital Surrogate Truth Sources to quantify margins and risks, project optimum course of action



The Digital Revolution

Physical Science + Data Science + Learning System = Velocity

Integrated Test Team - Stuck in a Document Centric Mode...



Current TEMP as required by the DODI 5000.02

- Represents a linear, document-centric, positional approach
- Not connected to changing Requirements
- Does not use all of the available knowledge / information
- Doesn't readily support optimization of T&E campaign
- Does not address generating the digital authoritative truth source through an integrated application of UQ

Test and Evaluation Master Plan (TEMP) requires 12 months to prepare and 10 months to review with up to 56 organizations at 8 levels involved in the review.

... and the next day someone changes a requirement and it is obsolete!!

... Moving to a Digitally Connected ITT, Digital TEMP



The Digital TEMP as an enabler for all of the digital transformations to reduce time/costs and assure Requirements are met

A Digital TEMP will

- Provide a model-centric approach dynamically coupled to digital Requirements
- Apply digitally captured system performance parametric sensitivities from trade studies to quantify T&E requirements
- Use digitally captured MRTFB capabilities / performance maps / schedules to identify gaps for investments to meet requirements
- Use digitally managed uncertainty measures for MRTFB capabilities with Requirements to develop optimum test campaigns

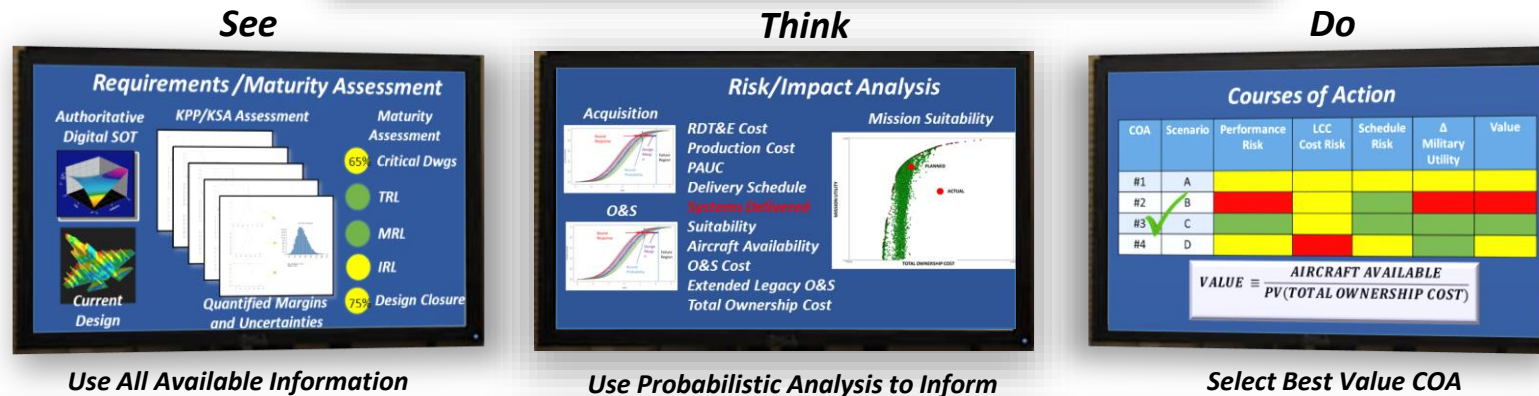
.... Think Digitally, Not Digitized

Decision Analytics

A Digital Critical Design Review

- **See** – bring all authoritative digital surrogate truth sources to understand and quantify margins and uncertainties in the performance of the system – do we have 90% confidence the system meets requirements, can be produced, and can be integrated?
- **Think** – use data analytics/probabilistic analyses to assess risk, impact on military utility, and total ownership cost of any requirements gaps
- **Do** – apply value-based decision analysis, Bayesian Belief Networks to select the best value course of action including data-driven risk mitigation strategies

Risk = Uncertainty with Consequences



Assuring a 90% Confidence Level at CDR That the System Under Development Meets Requirements and Can Be Produced Will Alleviate Most of the Post-CDR T&E “Ugly Baby” Syndromes