

# The Design of Complex Projects

MIT ESD.36 System Project Management

*Bryan R. Moser*





## Belief in a Project Plan

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A project manager generates a plan in response to an executive request:

- How can one judge the plan's integrity and quality?
- Do the diverse teams who will execute understand and agree with the plan?
- Is the plan built to evolve?

**Can one believe in the plan?**



# Abstract

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1. **Let's expose deeply embedded assumptions from scientific management** on the nature of work systems, and how these ways of viewing work and workers has (in some industries) reverted to beliefs similar to the original 1911 thought leaders.
2. The dynamics of work product, process, and organization today are strikingly different than the **centrally controlled factory of 1911**. Our **work ecosystem has changed**, yet we often revert to old tools and thinking. Let's observe what people actually do, rather than stated processes.
3. High performance systems including teams (engineering, sports, military, stage) exhibit characteristics that lead **to great results, yet may be inconsistent** with PMBOK, PRINCE2, P2M and other frameworks as *currently practiced*.
4. A generation of new practices is emerging, centered on **flexible team adaptation to the unique integrated product, process, and organization** at hand. These techniques promote an **architectural view** of the project and complex dependence as a socio-technical system.
5. A key **commodity is awareness**: planning is interaction that builds tacit knowledge, commitments, and coordination agreements. In a stable industry the awareness from past projects may be sufficient for ongoing performance. These stable (in product, process, and organization) work situations are becoming rare.
6. Over the last 15 years we have been involved in planning and execution of complex, globally distributed develop projects. We have made practical a practice we refer to as "**Project Design**".
7. Teams early on explore a **trade-space** of feasible plans against requested targets and scope. Rather than a single plan or forecast, they generate a **frontier of options** that emerge during early planning and over the life of the project. The act of design is **collaborative, iterative, and necessary** to built a great team along with a high quality pan.



## The Design of Complex Projects

1. Introduction
2. History and the Project Management State of Practice
3. Project Management and Complex Socio-Technical Systems
4. Overview of Project Design
5. Case Study
6. Conclusion



# Who is GPD?

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## ➤ Our Team

- Tech. Leaders from Complex Global Industries
- Innovators in Complex Program Management



## ➤ The Design of Global Projects

- Rapidly model and adjust plans
- Predict global coordination activity
- Drive attention to interactions of value

## ➤ GPD's Methods & Experience

- Models of integrated socio-technical architecture
- Behavior simulation including global factors
- 15 years of case experience





# Foundations of Project Design

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## ➤ 1994-1998: Breakthrough R&D & Practical Innovation

- Real-world factors for forecasting complex projects
  - University of Tokyo, MIT, University of Connecticut
- 

## ➤ Four generations of TeamPort courses and software.

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- Deployed in Americas, Asia, & Europe
- National Institute of Aerospace, NASA, Caterpillar, FIAT Industrial, EPSON, Carrier, Millennium Chemicals, BP, Xcel Energy, Accenture, CNH, Convergys, InterCall, University of Denver, Northeastern University, Scalent, Rogers, Virginia Tech, Tongji SEM, Pratt & Whitney



## Thought Leaders and Deeply Embedded Assumptions

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- *The Principles of Scientific Management* (1911)  
Frederick Taylor
- *Industrial and General Administration* (1917)  
Henri Fayol
- *Gantt Chart* (~ 1912) and *Organizing for Work* (1919)  
Henry Gantt



## Traditional Methods Rooted in 1912

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“The theory of the proper execution of work is that it should be **planned completely before a single move** is made, that a route-sheet which will show the names and order of all the operations which are to be performed should be made out and that instruction cards should be clearly written for each operation....

By this means the order and assignment of all work, or routing as it is called, should be **conducted by the central** planning or routing department. This brings the control of all operations in the plant, the progress and order of the work, back to the central point.”

Henry P. Kendall [Tuck 1912]



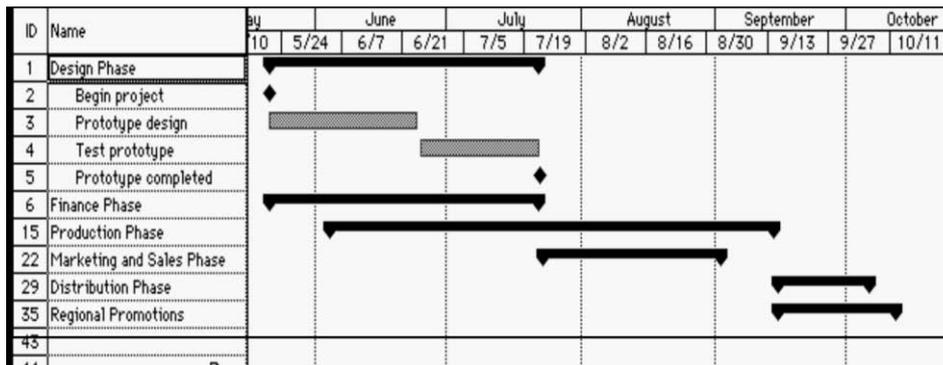
# Work In 1912: An Industrial Age

## A Century Old View of Work

- Factories with fixed, repeated tasks
- Narrow specialties & expert management
- Automated, replaceable resources

**AVOIDED IN 1912 Work**

**Communication, Uncertainty, & Adaptive Behavior**



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**The Gantt Chart is 1914 technology**

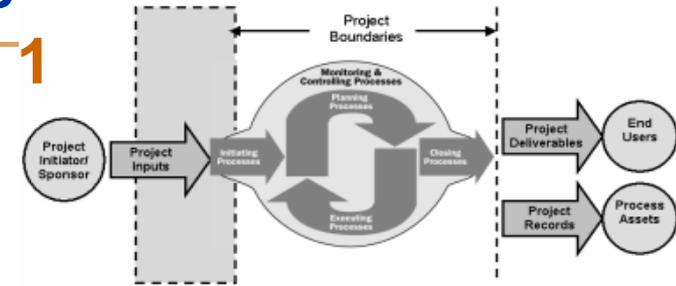


# Project Management Frameworks

1. PMI (1969) and PMBOK (1991+)
  2. PRINCE, PRINCE2 (1989+)
  3. PMAJ (1998) and P2M (2001)
- “Agile”... that’s a whole other lecture!

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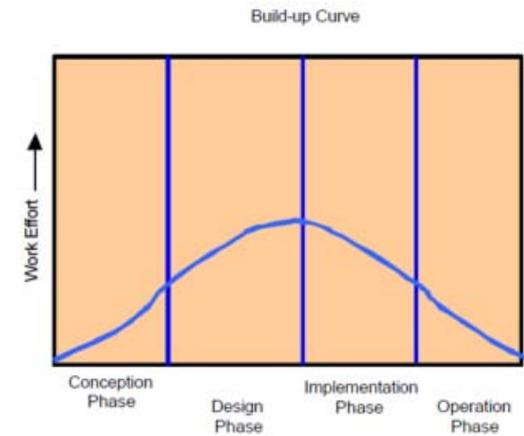


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2

1. Starting up
2. Directing
3. Initiating
4. Controlling a stage
5. Managing stage boundaries
6. Closing

3



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# Today: Coordination is Significant and Dynamic

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- Complex Dependencies & Concurrency
- Communication, Meetings, Teaming
- Decentralized Decision Making
- Just in Time Supply Chains
- Travel, Time Zones, and Workdays
- Languages and Cultures

**35% to 50% of activity** in modern work is ***coordination***, the interaction amongst teams.

**Traditional planning fails  
as these factors are misrepresented or ignored.**



# The State of Complex Systems Development

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- Multiple **layers of system and subsystem**, with substantive design responsibility layers down
- **Dispersed teams** and supply chain with less chance of a shared, common background
- Complex **dependencies fall across subsystems** owned by different teams
- Pressure to proceed with **dramatic concurrence**, increasing risk of rework, poor quality, and delay



# Large- Scale Complex Engineered Systems

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Images of various large-scale complex engineering systems have been removed due to copyright restrictions.



# Project Management & Systems Engineering

## ➤ 60,000 line Gantt Chart

- Complete system re-design of a critical global platform of
- 8 person office (PMO) to create and manage the Gantt chart
- Awards given to PM team, but...

## ➤ Execs and Team Leaders

- Little awareness of architecture
- Unable to see own role in context
- Didn't believe the schedule forecast

## ➤ All boxes checked...

- NASA shuttle replacement
- \$9B over 6 years

## ➤ Project Management

- Plans integrated, Checklists followed
- Earned Value calculated
- Gateways formalized

## ➤ Systems Engineering

- Requirements mapped, Scope defined
- Dependencies and Work Packages defined

Chart and Reality Diverge

“No Feeling for the Dependencies”

# Teamwork under Complexity

The Design of Complex Global Projects



# Shifting Models of Organization

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Models of “organization” have shifted from **centrally controlled mechanical** systems to **dynamic organisms** with distributed, adaptive, and behavior based subsystems.

- planning and forecasting, organizing, commanding, coordinating, and controlling (**Fayol**, 1916)
- structure, hierarchy, authority, roles (**Weber**, 1924)
- as systems with boundaries, goals, incentives, behaviors (**Simon**, 1962)
- differentiation, formalization, complexity, centralization, span of control, rules, procedures... (**Burton**, 1995 and others)



# Work as a Socio-Technical System

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Projects viewed as a **socio-technical system** if we include the delivered systems and “Humans in the Loop”

- People do **work**, process **information**, and **interact** as part of an organization
- Individuals **allocate attention** based on behaviors within limited capacity
- Organizations with architecture and culture exhibit **emergent behavior** (e.g. exception handling, quality...)



# Coordination

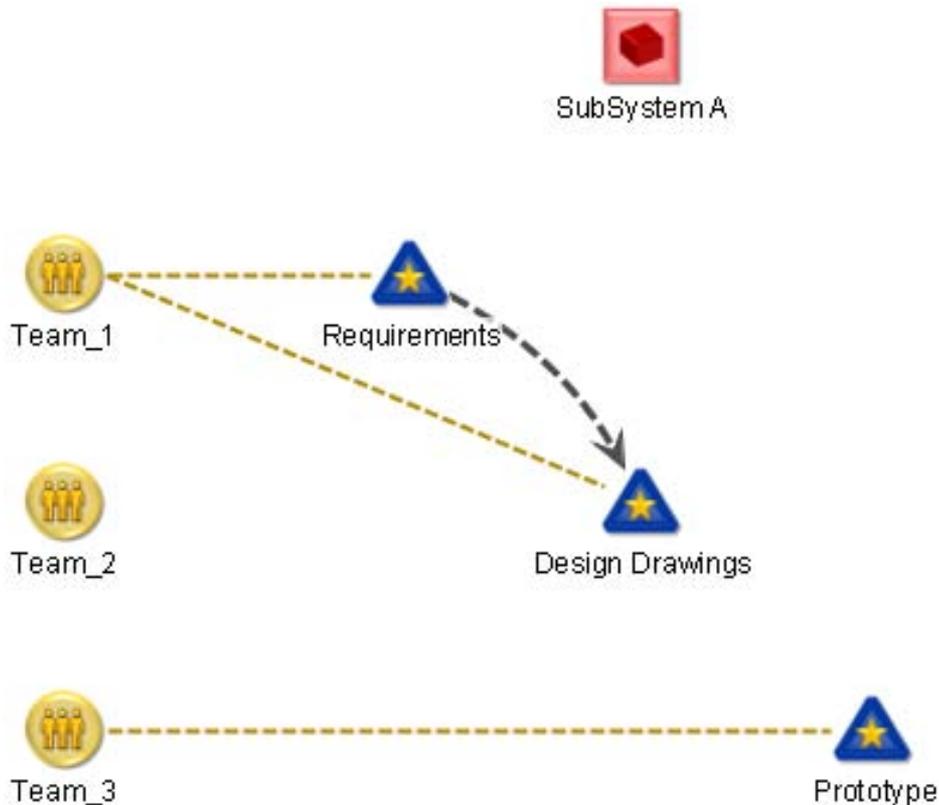
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- Coordination is the activity to manage dependencies.  
(Malone & Cranston, 1994)
- What portion of your weekly effort is spent coordinating?
- What happens to items in your inbox when it overflows?

*Manufacturing has shown for decades that managing human attention is a key: if we over-automate, quality drops*



# Project Architecture & Coordination



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*The demand and supply of coordination activity are driven by the integrated architecture of the project.*

Three activities to realize a subsystem. Three teams.

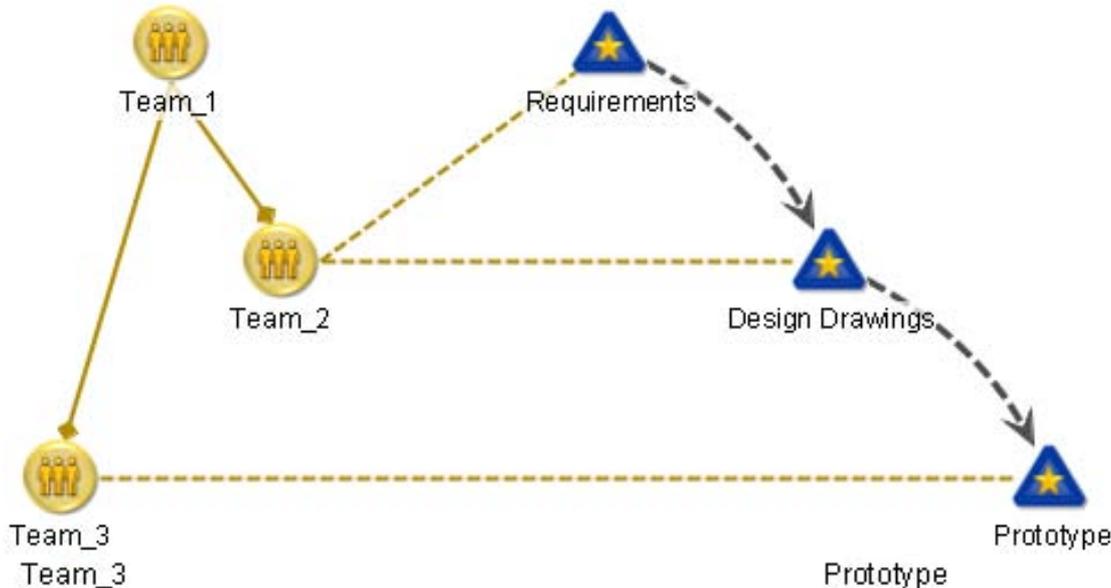
- Independent activities.  
Where will coordination occur?
- Dependent activities.  
Where coordination?
- Changed pattern of roles and dependence, yet scope and resources unchanged.  
Where Coordination?



# Project Architecture & Quality



SubSystem A



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- Organization attributes matter. They can be observed, measured, and their impacts predicted.
  - If we do not explicitly predict, we assume that teams behave according to **(our)** past experience.
- Teams have structure.  
What coordination is this?  
What impact on performance?  
→ “Exception Handling”
  - Dependent activities.  
Why does capacity of Team\_1 now matter?  
And in this case?
  - What if:  
Teams in different time zones?  
Teams speak different native languages?  
...



# Design of Projects in a Complex Environment

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- Work cultures evolve over time to align behaviors, promote learning, and control risk.
  - Through a **stable career one knew** which interactions mattered, and others were “on the same page.”
  - Today **coordination and risk arise in unexpected places**
- Attention to coordination is not “soft”. These are **real attributes** of time, cost, and quality
- Cases in complex global industrial programs confirm observed behaviors and sufficient **predictability**
- **Design of a project architecture** can weigh team capacities and strengths, coordination, and flexibility

# Introduction to Project Design

*A core capability for teams*



# GPD's Approach: Project Design

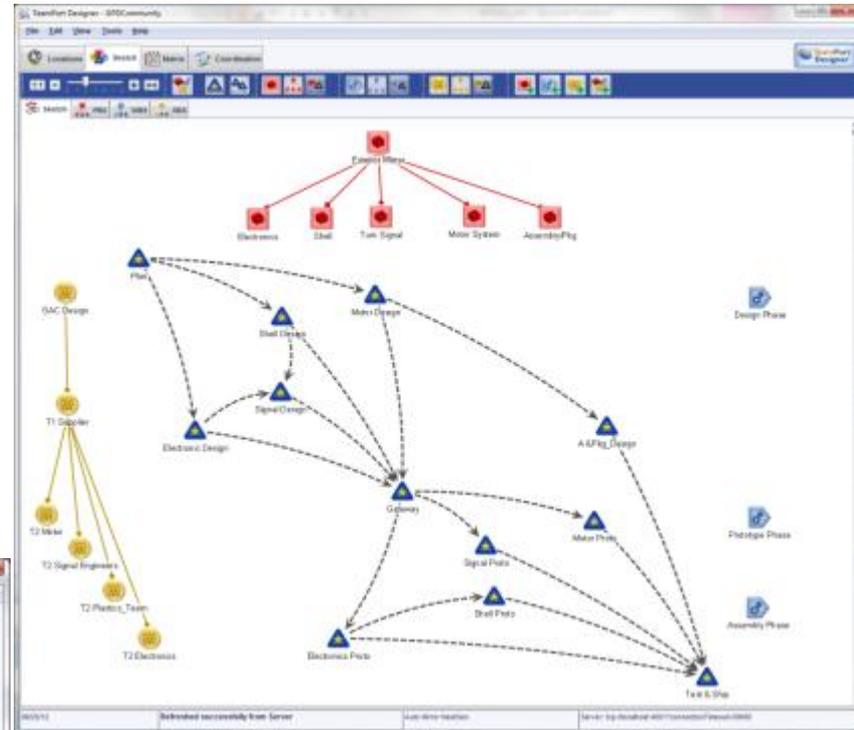
1. Early on, the “team of teams” establishes a **platform for collaborative decisions**, using visual models and analysis to develop situational awareness and consensus
2. Teams specify the manageable set of “top down” project characteristics to **forecast scope, schedule, cost, and risk**. Detail is reserved until needed.
3. Teams **rapidly and repeatedly simulate projects**, including real-world coordination, to create confidence-backed, sustainable, achievable, optimized design of their actions



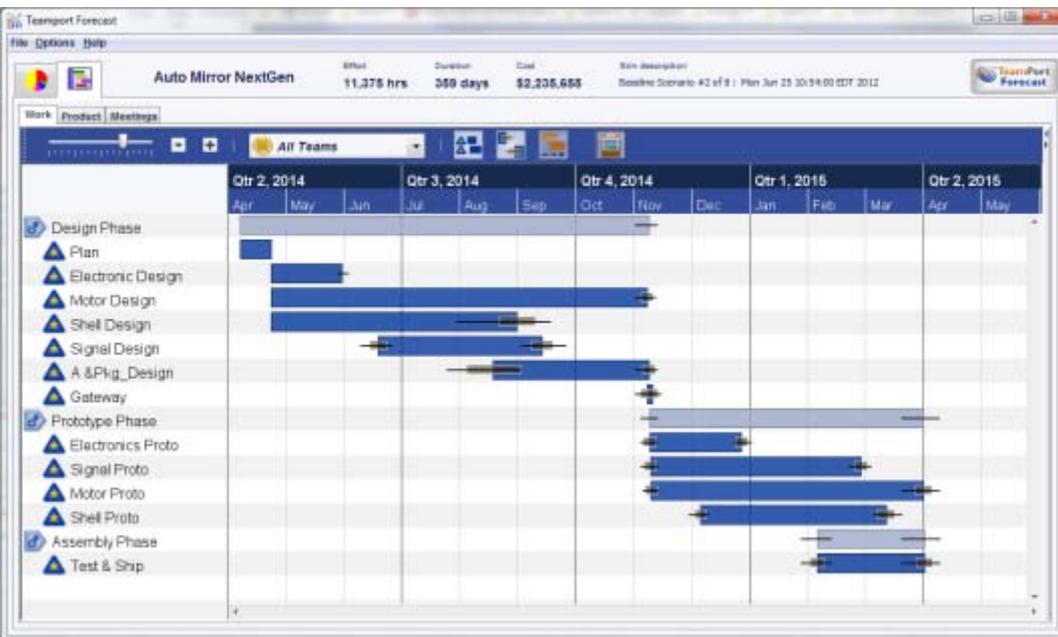


# Rapid model & simulation of complex work

- Platform for Program Dialogue
- Collaborative Visual Design
- Forward-looking Forecasts and Analytics



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# Rapid, Iterative Forecasts Lead to Situational Awareness

- An **engaging experience** for teams similar to:
  - practices in sports
  - field exercises in the military
  - rehearsals for performance
- Early planning includes feasibility as part of **charter and strategy**





# TeamPort Project Model Elements



➤ **Products** are the meaningful result of completed work.

- includes activities as scope and progress to realize the product.
- grouped as a Product Breakdown Structure (PBS).



➤ **Teams** are people who make effort to work and coordinate by applying abilities.

- work on activities through contracts to indicate a role.
- grouped as an Organizational Breakdown Structure (OBS).



➤ **Phases** are grouped activities that represent flow of progress over time.

- stages of scope and progress may stretch across multiple products
- used to build a Work Breakdown Structure (WBS).

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# Activity

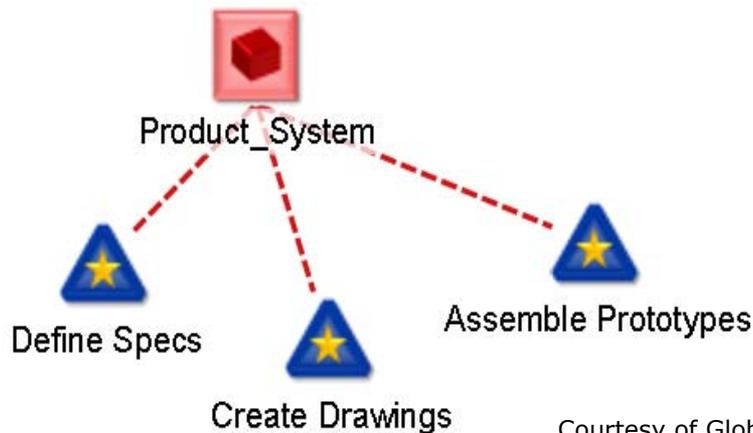


➤ Scope demanded to deliver part (or all) of a product

- progress units
- nominal effort
- skills required
- complexity

➤ Assigned to teams through a pattern of roles

➤ Can be grouped in Phases



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# Contracts: Teams assigned to Activities

Role	Responsibility
<b>Primary</b>	Ensures the activity completes and coordinates with others. 0-100% of nominal work effort.      100% of the communication effort
<b>Decision</b>	Handles exceptions should a quality issue be escalated. 100% of the decision making effort
<b>Quality</b>	Reviews work in progress to discover errors and escalate decisions about rework. 0-100% of the QA work effort
<b>Assist</b>	Lends its capacity to the primary team for nominal work only. 0-100% work effort at their level of ability

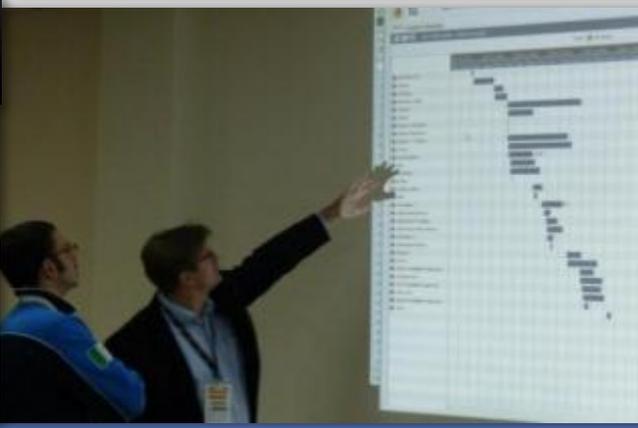
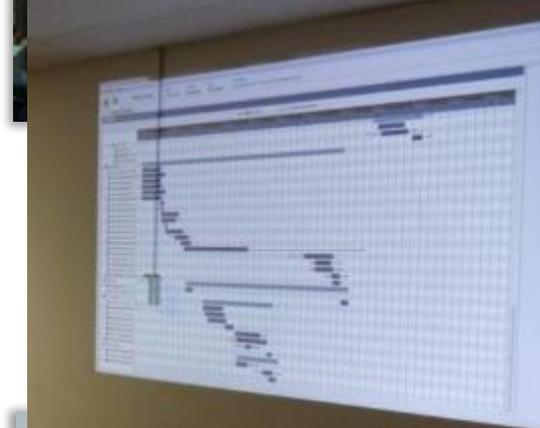
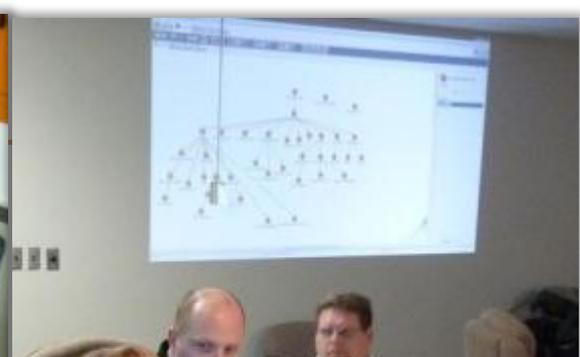
**analyze**

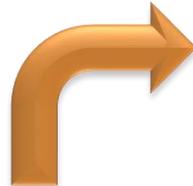
92 hrs total effort(FTE)  
18 Tests at finish

Effort	Progress	Dependence	Contracts	Notes																				
			<table border="1"> <thead> <tr> <th>Team</th> <th>Primary</th> <th>Decision</th> <th>Quality</th> <th>Assisting</th> </tr> </thead> <tbody> <tr> <td>Sandy</td> <td><input type="checkbox"/></td> <td><input checked="" type="checkbox"/></td> <td><input checked="" type="checkbox"/></td> <td><input checked="" type="checkbox"/></td> </tr> <tr> <td>Ken</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td>Adam</td> <td><input checked="" type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input checked="" type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> </tbody> </table>	Team	Primary	Decision	Quality	Assisting	Sandy	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Ken	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Adam	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
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Ken	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>																				
Adam	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>																				

Phase \ Team (Contracts)	Sandy	Ken	Adam
design	PDQ		
program	D	P Q	
analyze	DQA		P Q
review	PDQ	Q	

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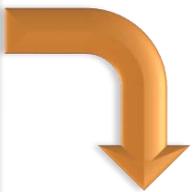




**TeamPort Designer**

Visual modeling & complexity

- Top-down & linked to strategy
- Product, work, & teams
- Global roles & priorities
- Concurrent dependencies

Smart Dialogue & Team Decisions



**TeamPort Simulator**

Unique insight from predictive analytics

- Analyzes coordination effort & costs
- Real-world behavior & uncertainty
- Constraints of team distribution
- Detailed output from hi-level input




**TeamPort Forecast**

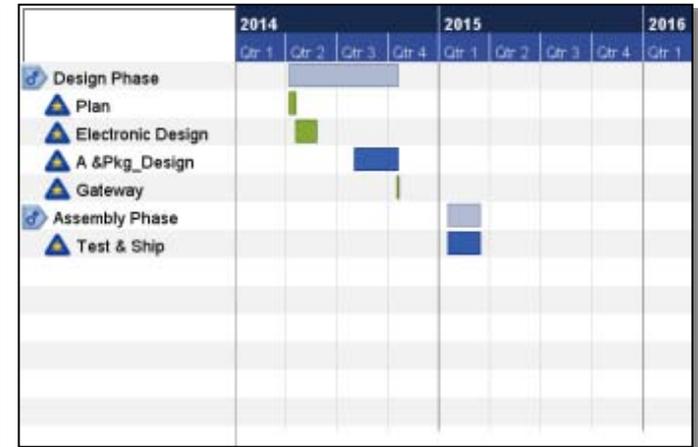
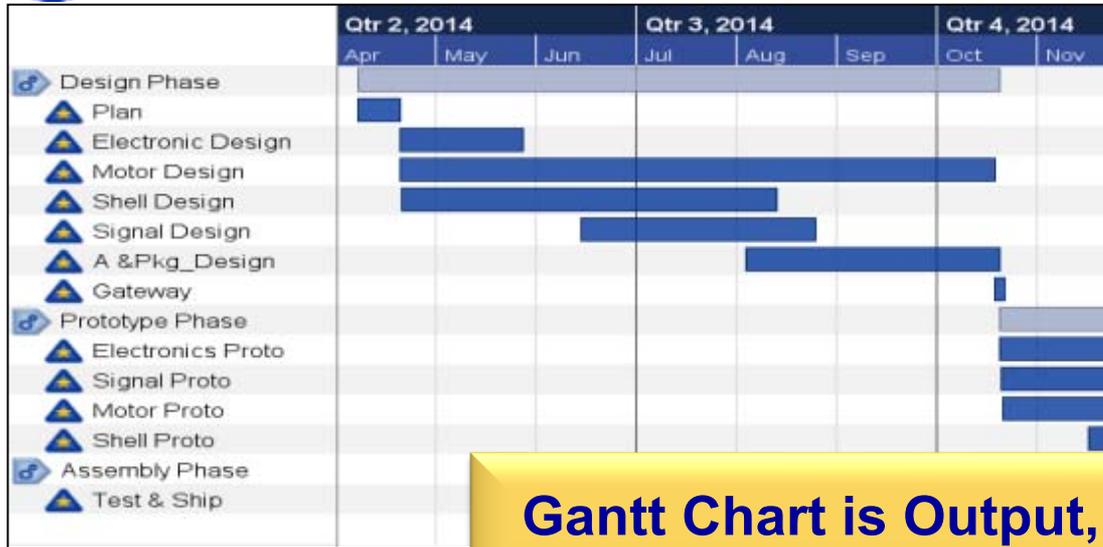
Review of realistic plans, scenarios & options

- Product & phase schedules
- Team progress, efforts, costs
- Concurrency, wait, & re-work
- opportunities & risk

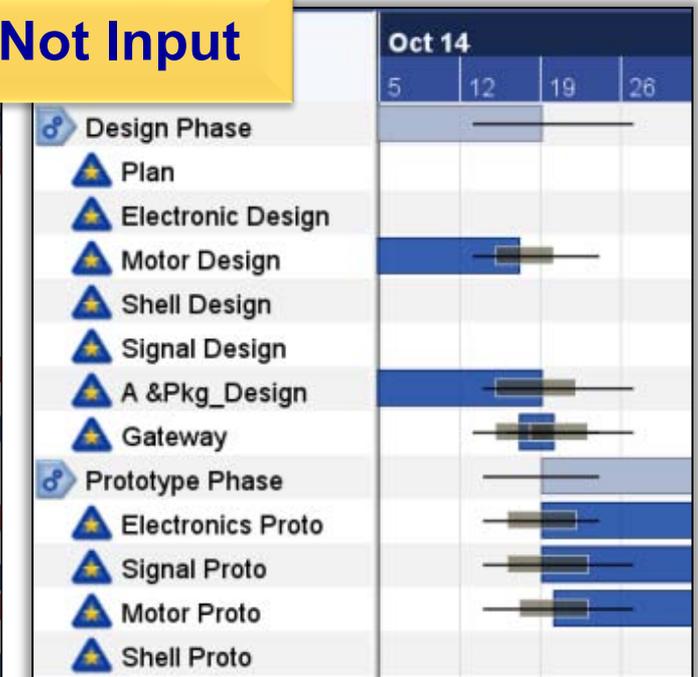





# Forecasts from multiple viewpoints



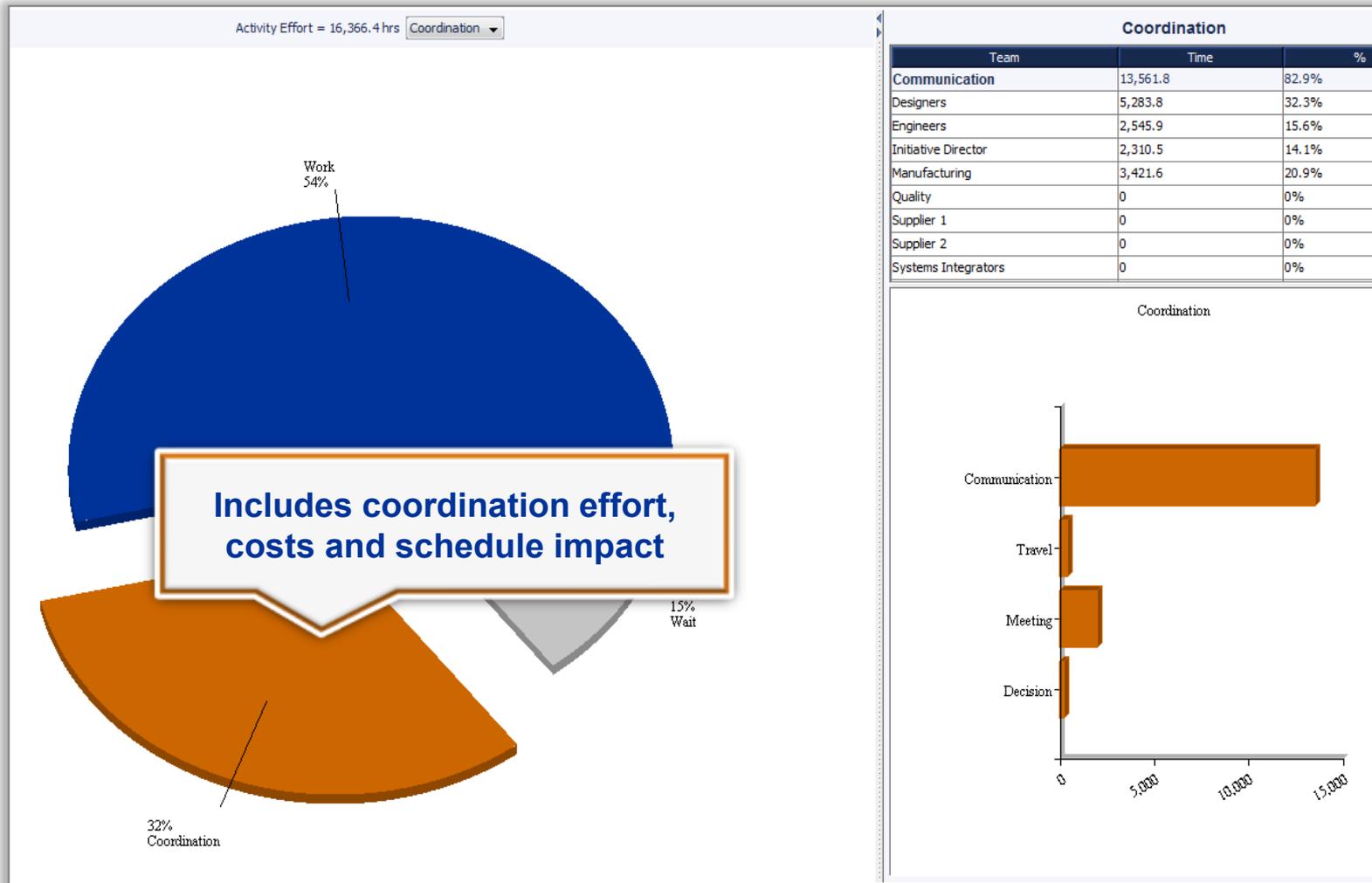
**Gantt Chart is Output, Not Input**



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# Forecasts include Work, Coordination and Wait

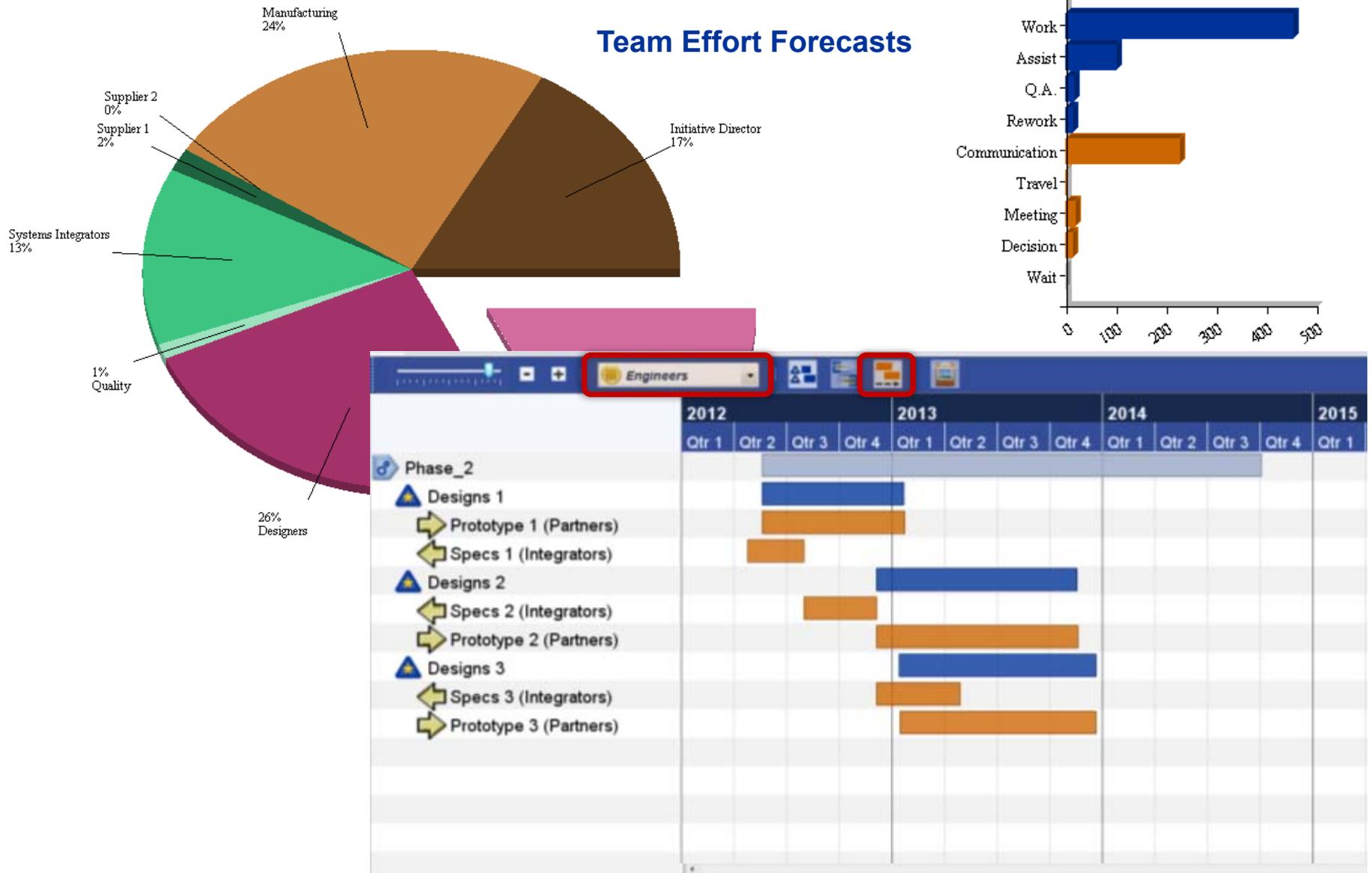
- **Coordination** activities **across teams** are predicted
  - unlikely to be anticipated based on previous experience.



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# Coordination as Real Effort with Impact on Schedule



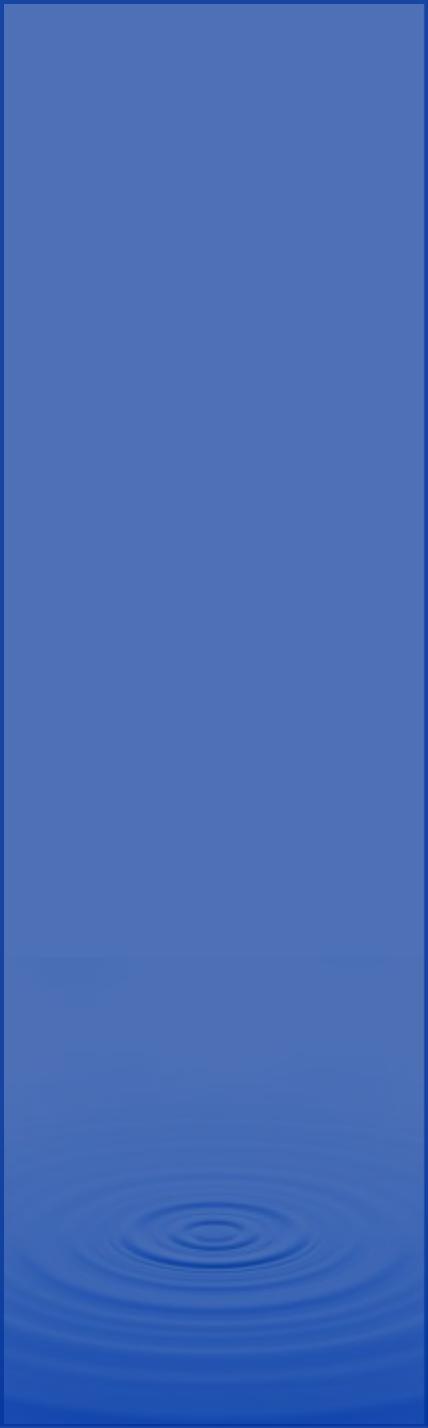
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# Project Design as a Team Decision Platform

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- Project design generates a plan. And options. The plan represents **teams' consensus** of role, feasibility, optimality, and coordination approach.
- The plan is a **social instrument**; a dialogue amongst teams, not just a control instrument. Teams interact from their own point of view.
- Failure is visual before starting; allows team leaders to **re-think how to participate**. Architecture and complex dependence emphasized.
- The exercise **exposes assumptions** and prevents wishful thinking. Teams see sensitivity of total project results to their own actions.
- **Situational awareness and performance** emerge as teams understand, commit, rehearse, and adapt ongoing.



# **New Product Development: Common Platform across 4 Global Regions**

2006

Retrospective Analysis: Client shared status of project at first gateway and asked “What could we have seen at that point?”



## Situation

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- **Approximately 143,000 hrs of direct work effort for Concept, R&D, and Design Center based development.**
- **85% of scope was visible before G2, but only 54% accounted for in baseline schedule & budget.**
- **~10% of effort was Preparation of Global product concept at the Lead Design Center.**

### Gateways

**G0 – start**

**G1 – concept**

**G2 – design**

**G3 – engineer**

**G4 – manufacture**

**G5 – release**



### Three Scenarios were modeled:

1. Original Scope (~63k hours)
2. #1 + Options (~92K hours)
3. #2 + Scope Increase (~111k hours)

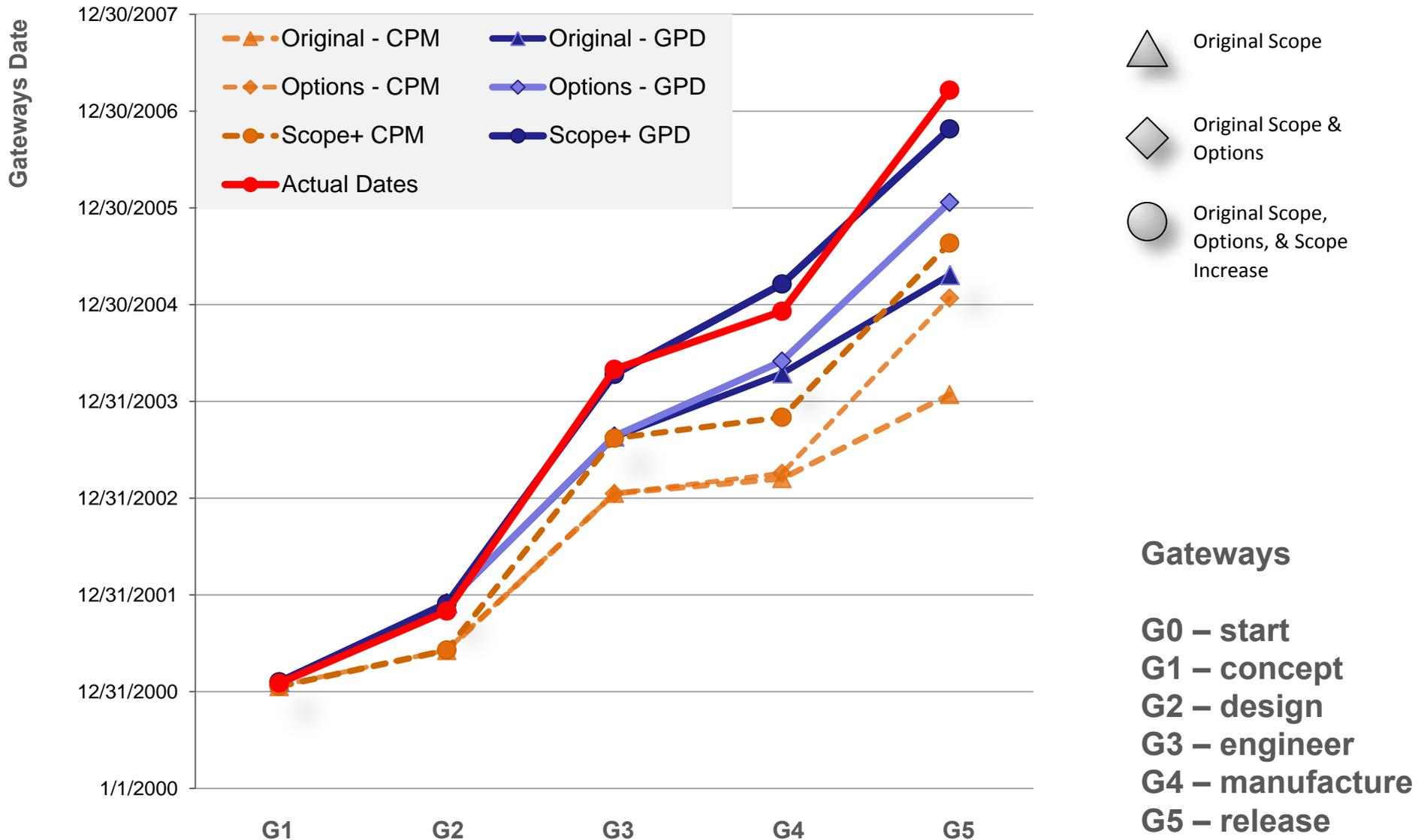
Each **simulated using CPM & GPD** methods.

**CPM** refers to the **Critical Path Method** as used in traditional tools. CPM ignores communication, time zones, mutual dependence, re-work, and other global factors.

**GPD** refers to analysis by **TeamPort** which incorporates communication, complex concurrency, re-work, time-zones and other factors.

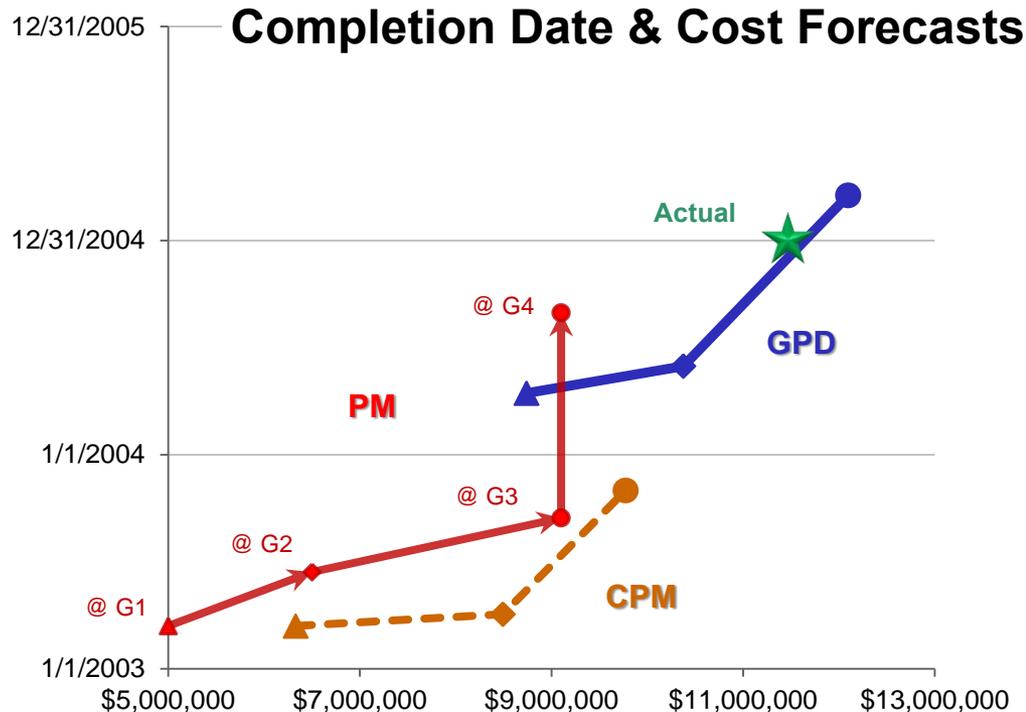


# Comparison of Forecasts: Schedule Gateways





# Comparison of Forecasts: G4 x Cost



- △ Original Scope
- ◇ Original Scope & Options
- Original Scope, Options, & Scope Increase

Program G0  
October 2000

- PM** forecasts by project team at each Gate during project.
- CPM** forecasts (critical path) ignore coordination, concurrency, and re-work realities.
- GPD** forecasts consider coordination, concurrency, re-work, time-zones and other global project realities
- CPM & GPD** forecasts generated by TeamPort

## Gateways

- G0 – start
- G1 – concept
- G2 – design
- G3 – engineer
- G4 – manufacture
- G5 – release

## On Dependence

To enable Project Design across  
Teams at Conversation Speed

More Knowledge with Less Detail  
is Critical



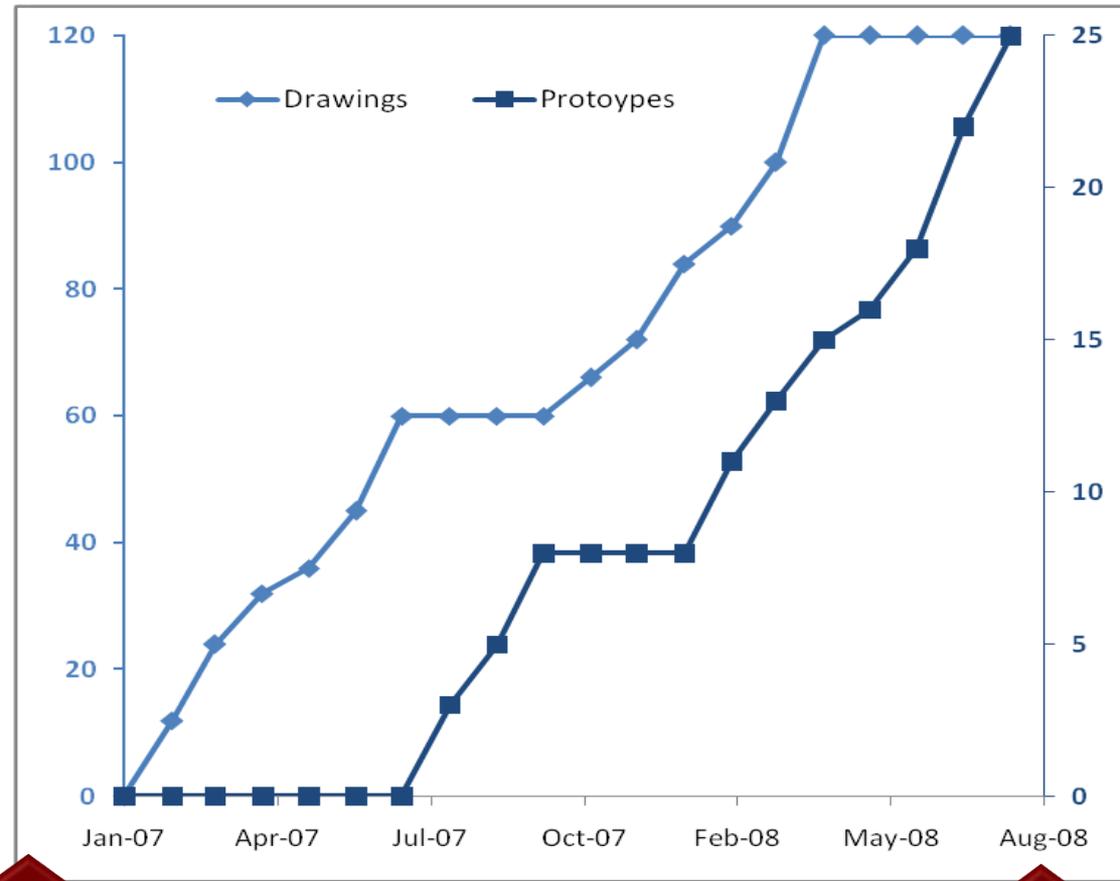
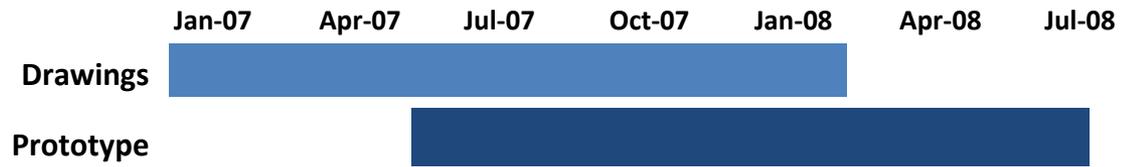
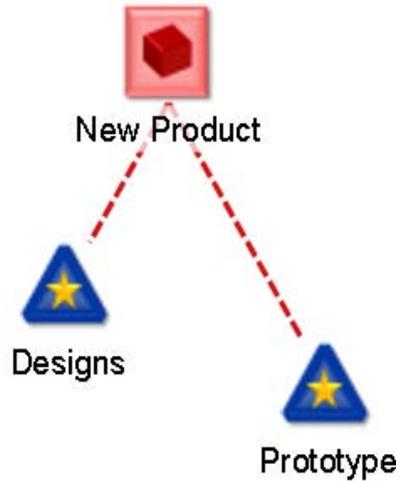
## Quick Assignment

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- Find a definition of “dependence” in project management from either original thought leaders OR as described in a recent standard.



# Forecasts of Progress



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# Traditional Task Dependence

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## ➤ Precedence Relationships

- “A must be finished before B can start”
- $A \rightarrow B$
- Also called “Finish to Start” or FS Dependency

## ➤ Also FS, FF, SS and SF

- FF: “A must be finished before B can finish”
- SF” “A must be started before B can finish”
- SS: “A must be started before B can start”

## ➤ Other ways to extend precedence relationships

- “Lag” factors added:  $A \rightarrow B$  with a lag of 3 days
- Milestones: Milestone M in A must be reached before B can start

A relationship between two milestones: *points in time.*



## Problem: Precedence is a RESULT not a CAUSE

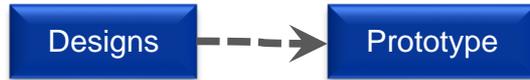
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- Traditional dependencies **bury insight** about WHY
- These assumptions often **not shared or forgotten**
- Ongoing **coupling** between activities is not captured.

Better practice is to capture during project design  
**dependence as an underlying need**

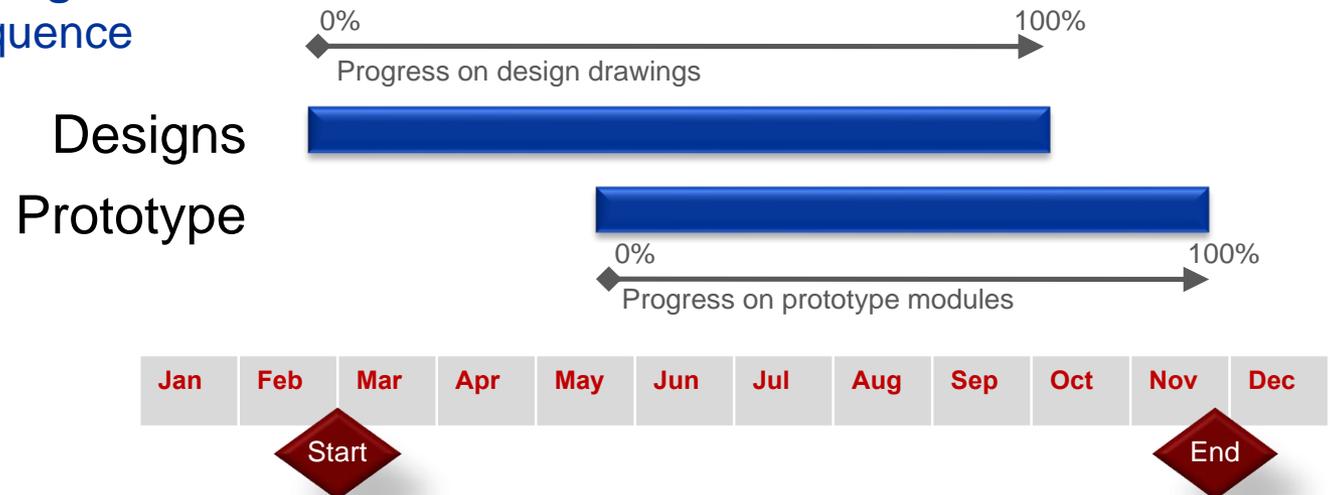


# Dependence, Progress, & Coordination



- Dependence traditionally shown as **discrete** sequence
- Dependence in modern, complex projects is **continuous, concurrent, and mutual**
- **Relative pace and progress** matter more than sequence

- How does relative progress impact cost, duration and quality from Start to End?
- Dependence shown as need to coordinate during progress.
- A forecast predicts impacts of not coordinating well.

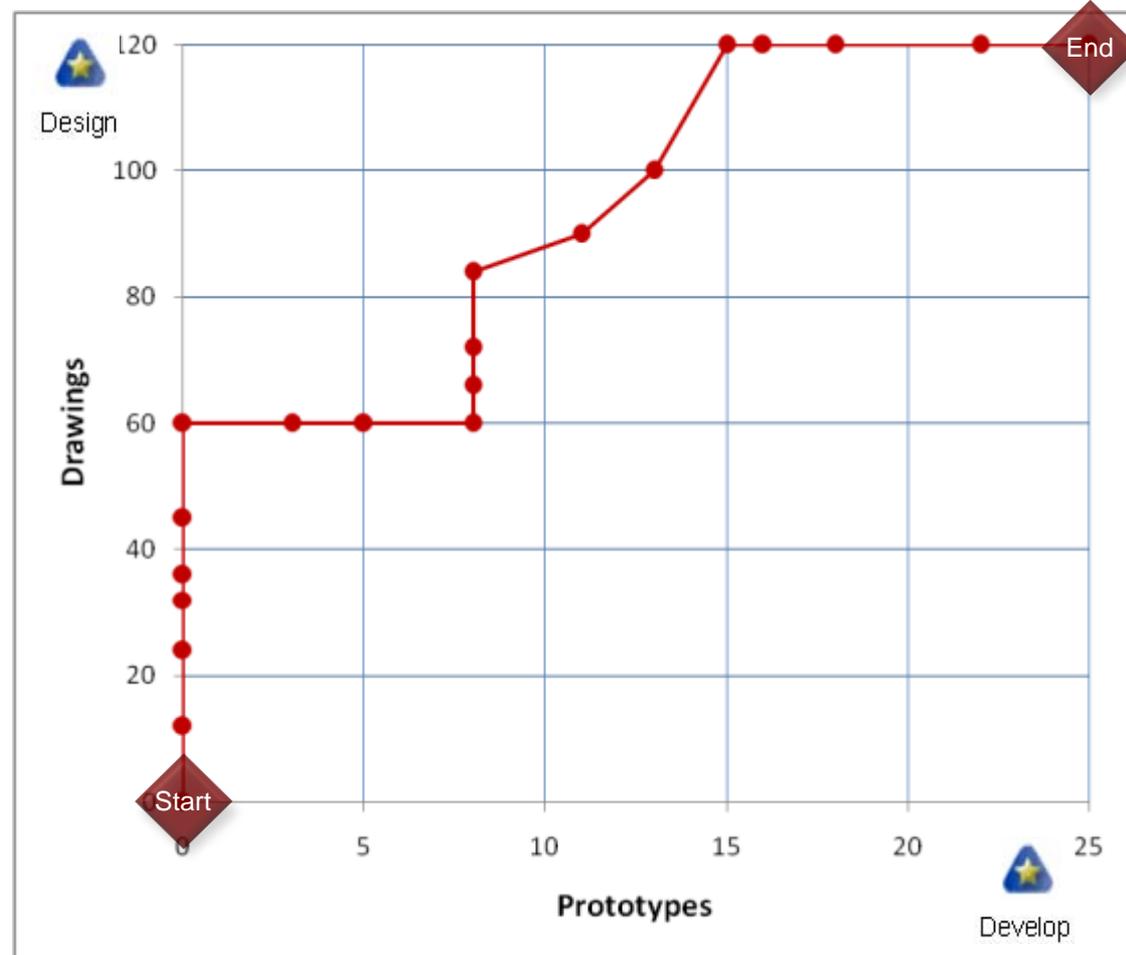
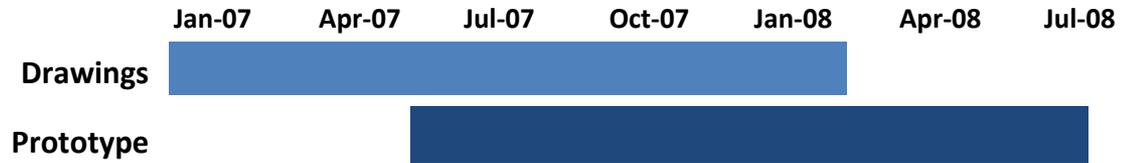


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# Concurrent Progress

- Diagram shows relative progress
- More suitable for capturing ongoing dependence

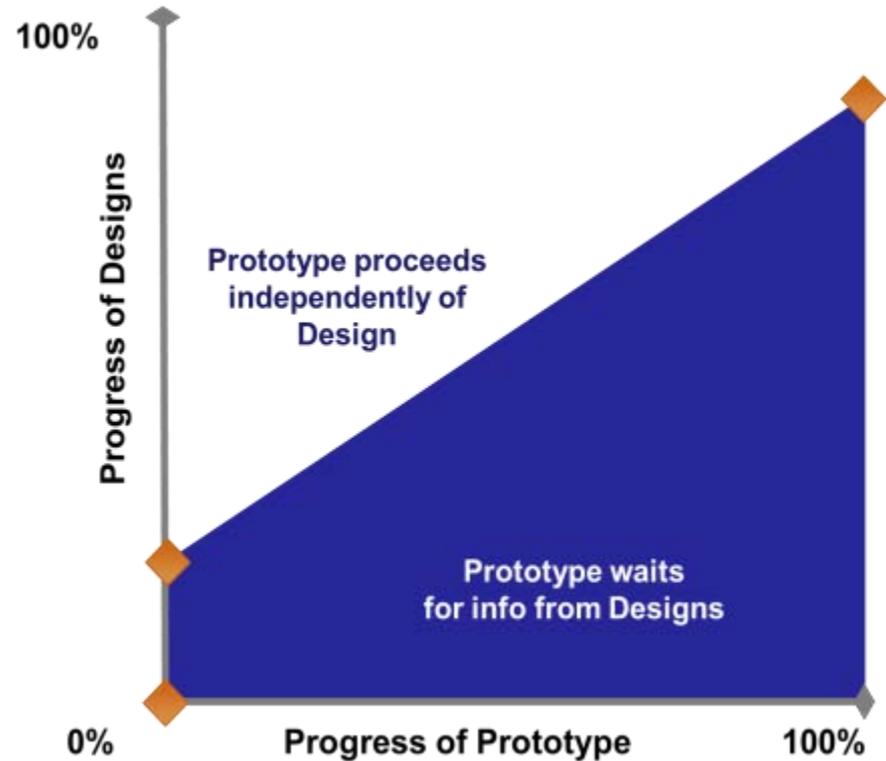
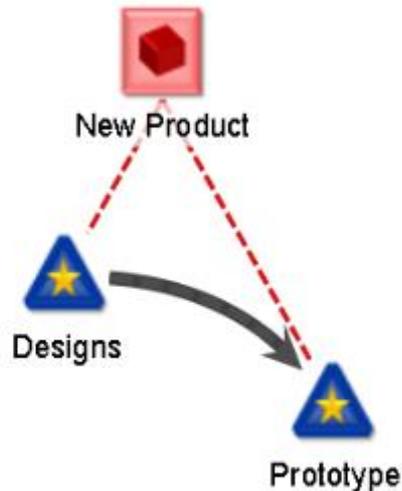


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## Activities are *dependent* if ...

- ...progress in one activity requires progress in another.
- There is a **NEED** for results, information, or resources.

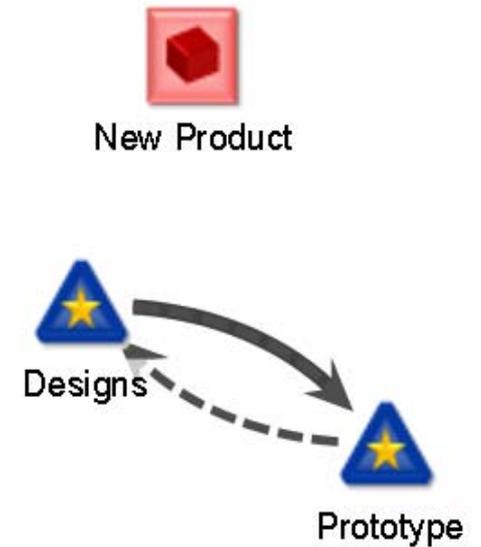
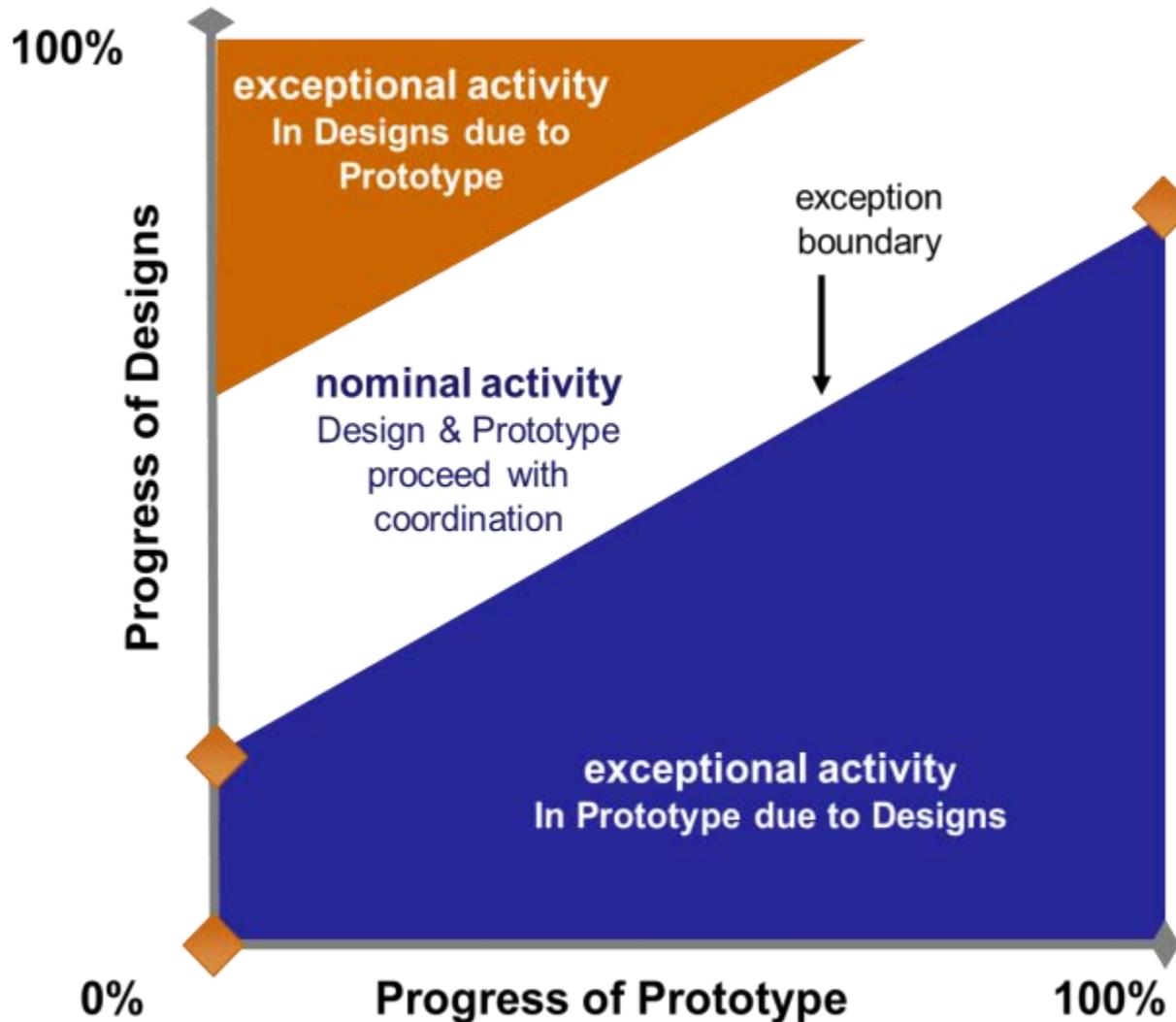


*“We can’t begin until their work has reached an early milestone, then in general we can proceed in parallel as we receive drawings and some discussion.”*

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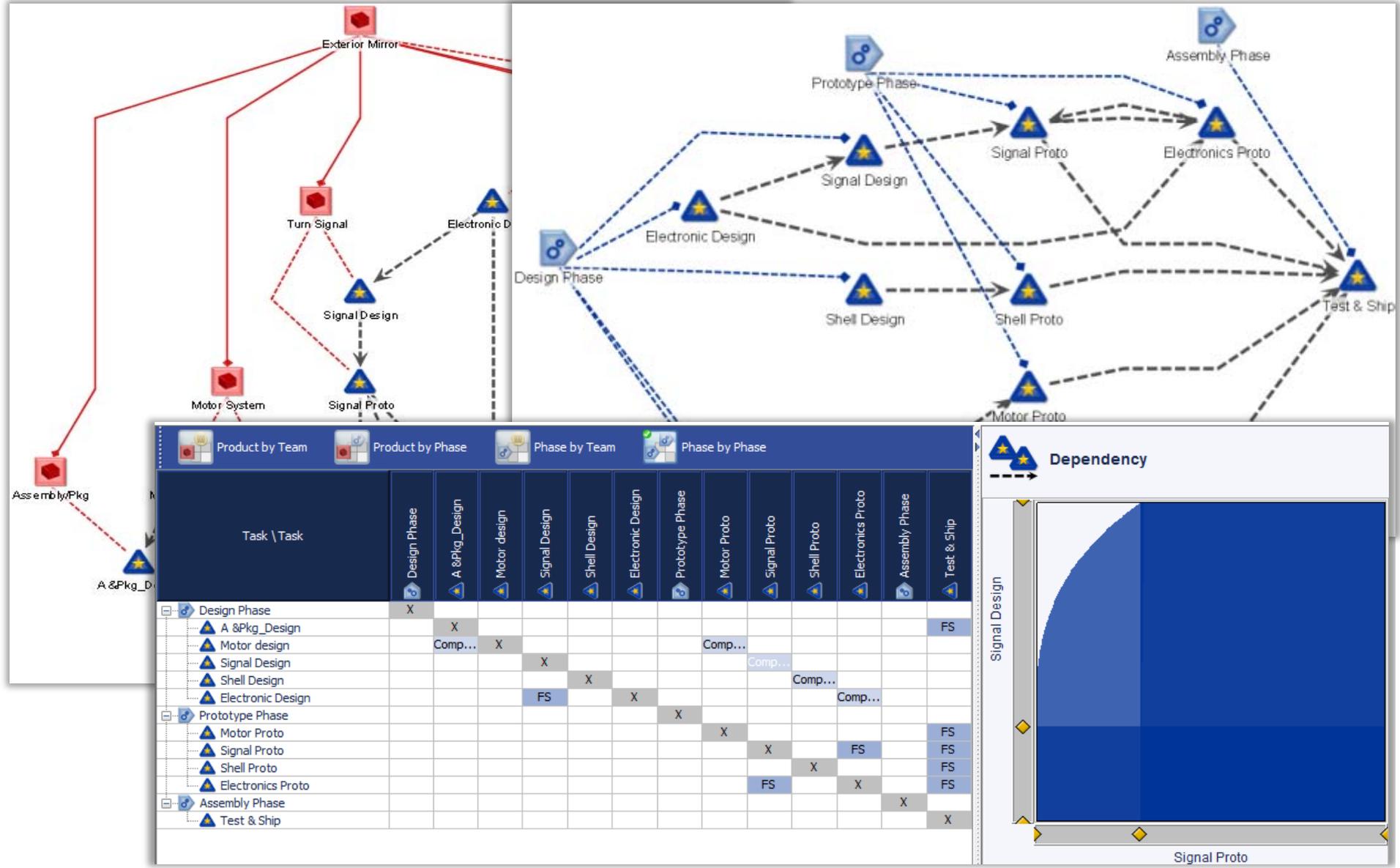
# Concurrent, Mutual, & Exception Triggering Dependencies



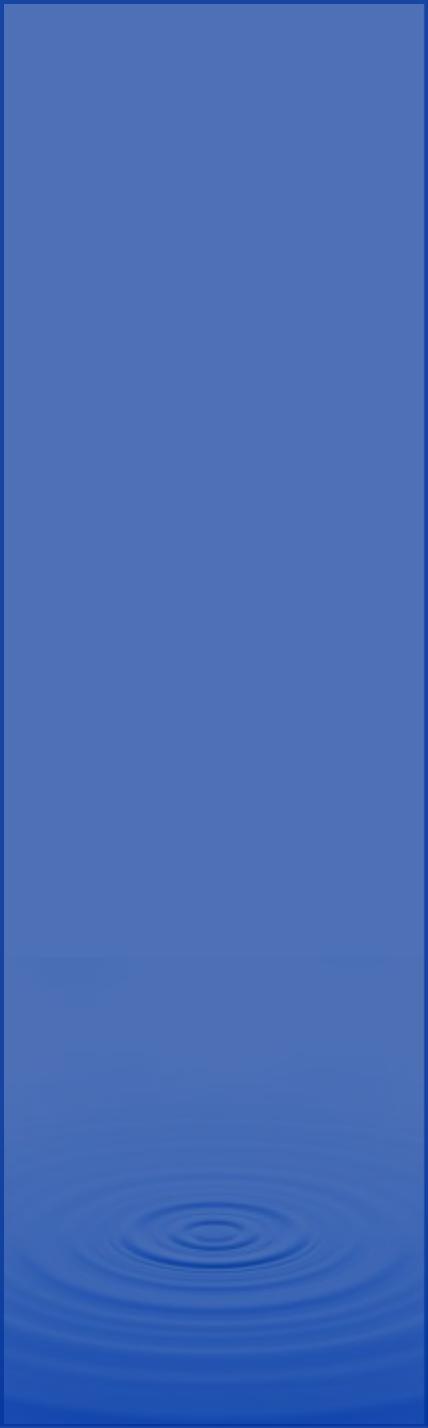
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# Architecture: Complex dependence (concurrent & mutual)



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# **Vehicle Development, Prototype Testing, and Manufacture**

2010 Case Study



## Case Situation

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- Heavy Equipment Development and Prototype Testing
- 5 key sites: 2 in Europe, 2 in USA, and 1 in Brazil
- Relatively Small Core team effort (>15,000 hours), yet constrained facilities, limited test vehicles, rework risks
- Driven by regulatory deadline



# Cross Functional Team Workshop

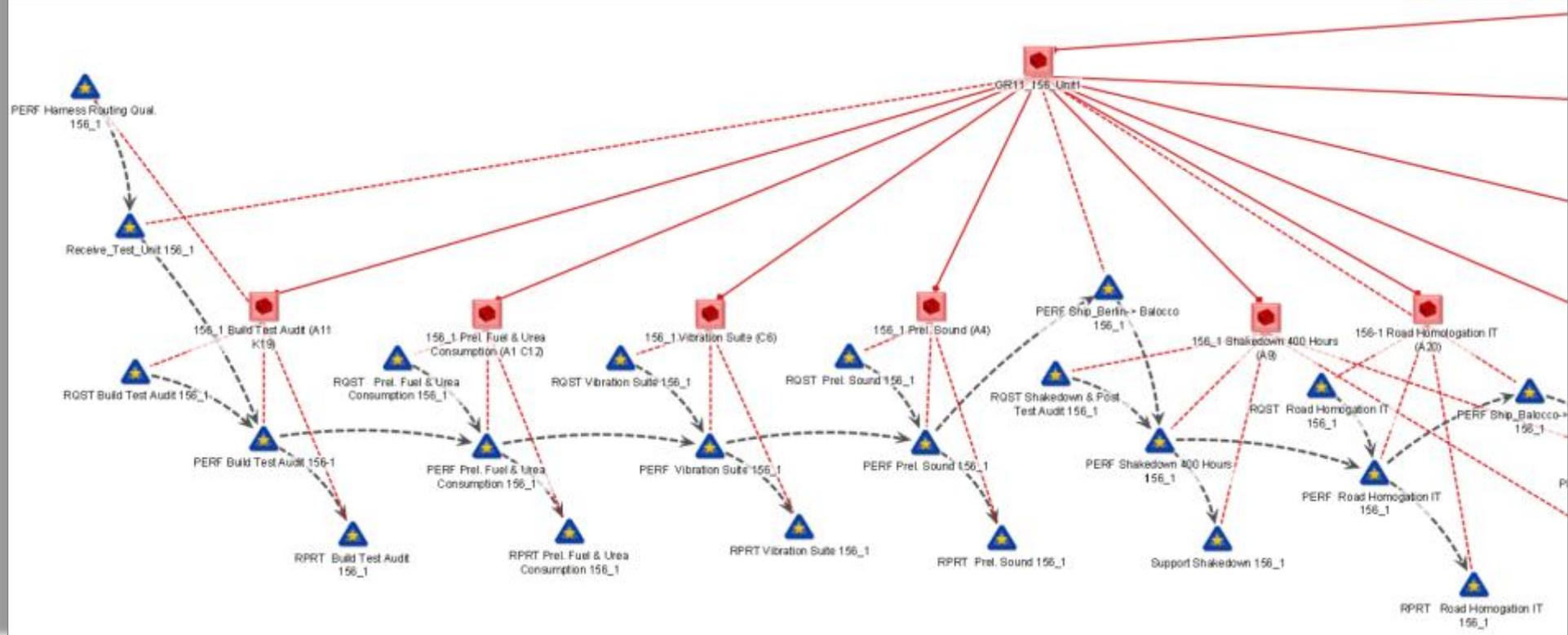
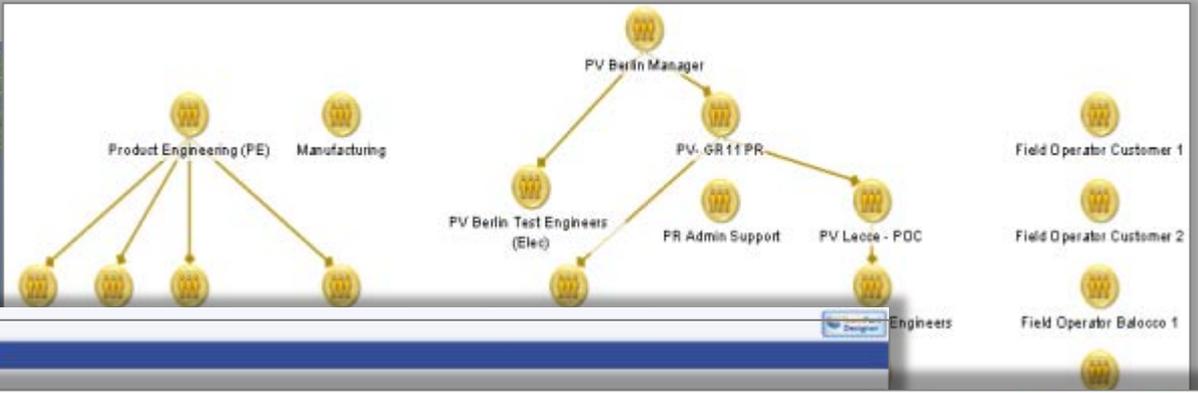
- 60 scenarios generated in initial workshop. 40+ scenarios since workshop.
- Weekly sessions generating 4 new “What-If” forecasts in 1 hour.
- Dialogue focuses on project substance; not planning process or tools





# Project Design Case: Vehicle Prototype

## Rapid Visual Project Models

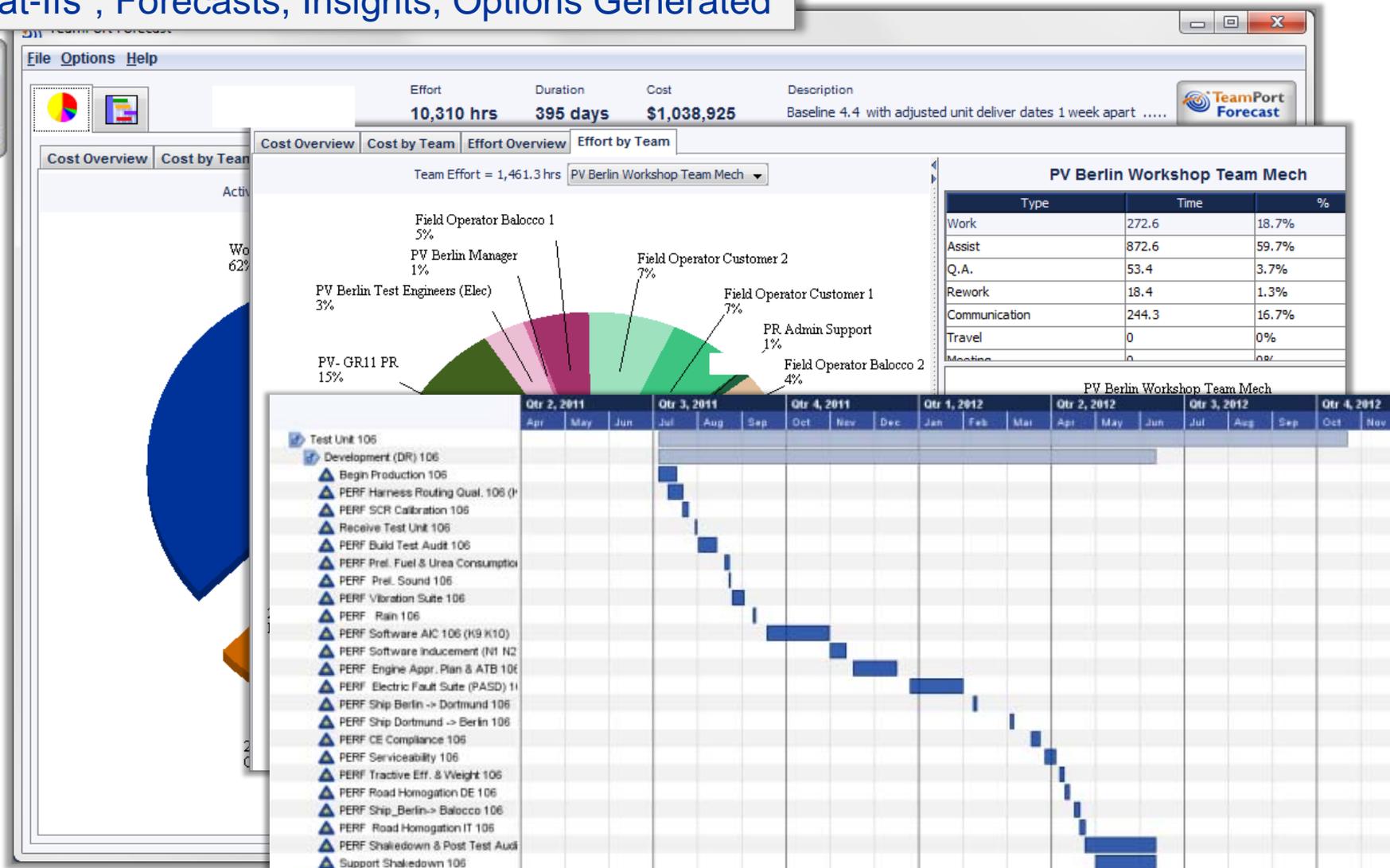


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# Forecasts: Schedule, Utilization, and Efforts are Output

“What-Ifs”, Forecasts, Insights, Options Generated

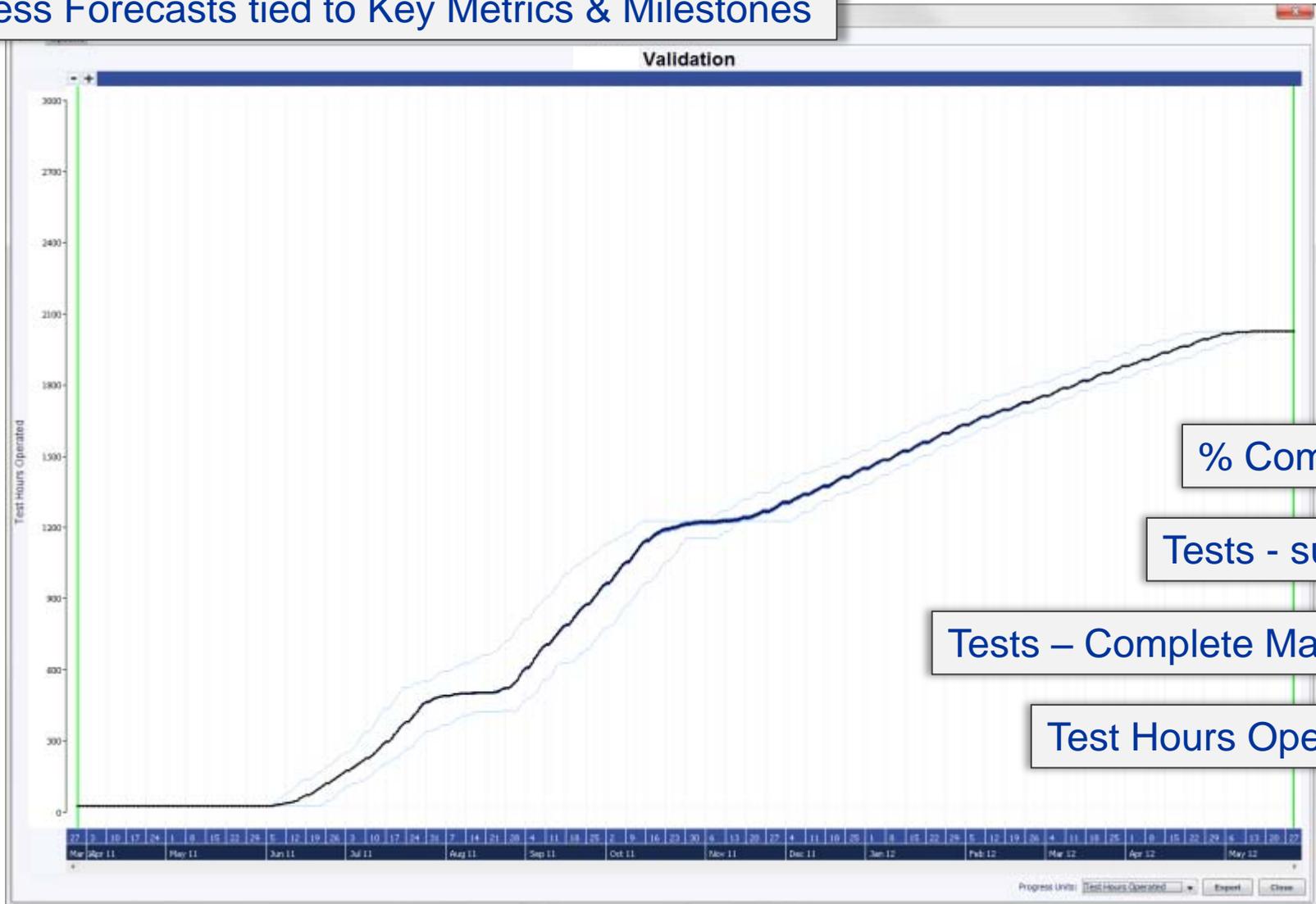


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# Progress Timelines: Metrics & Variance

Progress Forecasts tied to Key Metrics & Milestones

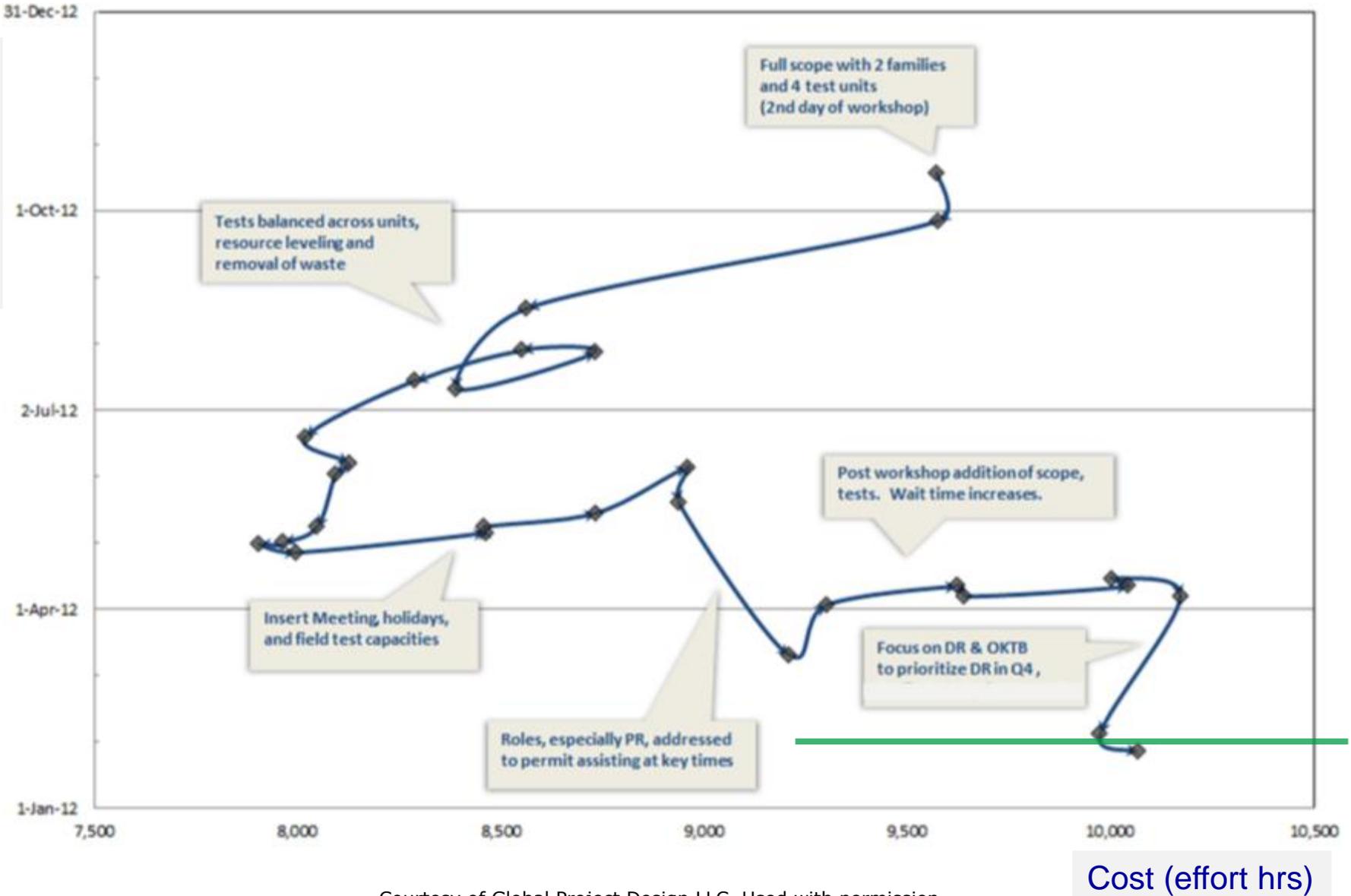


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# The “design walk”

Completion Date

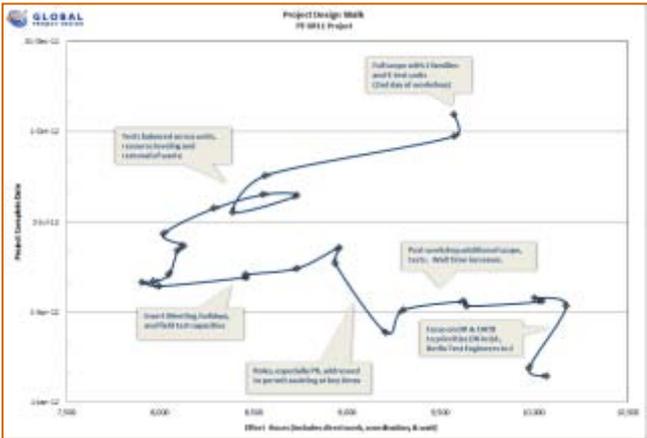


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# Solution - Design walk vs. re-design “tug-of-war”

## ➤ The design walk



VS.

## ➤ The re-design tug-of-war

Image of “tug-of-war” removed due to copyright restrictions.

**Teams build situational awareness and holistic view of trade-off space**

- Availability dates slip and scope is added
- Project manager responds with new plan to improve schedule

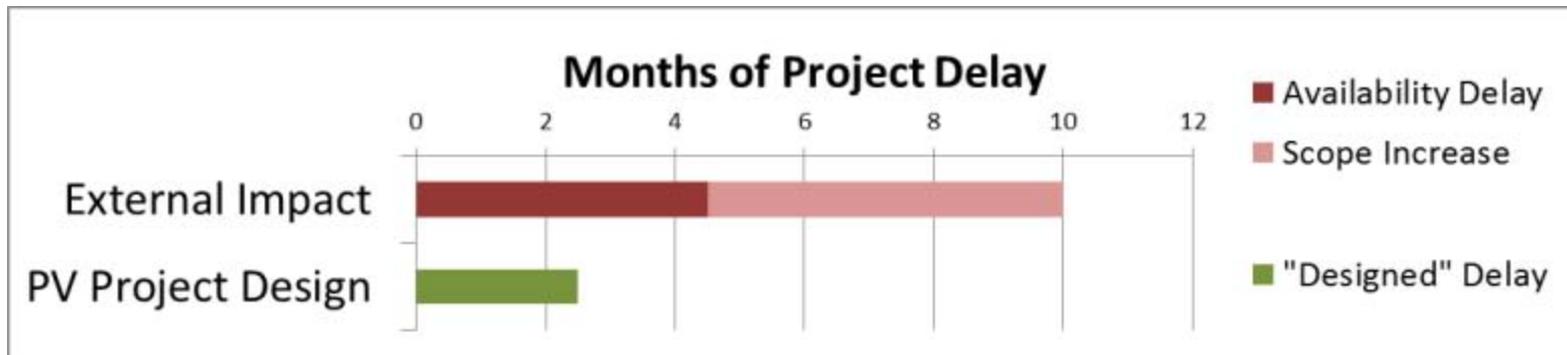
“Pullback”

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## Result – Message to management

- With a few hours of re-design, CFT was able to take the following message to senior management ...
  - Despite machines arriving 4-5 months late and ...
  - ... despite scope being increased by 3-8 months per machine, ...
  - ... Project (re-)Design “pulled back” these delays to 2.5 months



- ... and that message was well-received

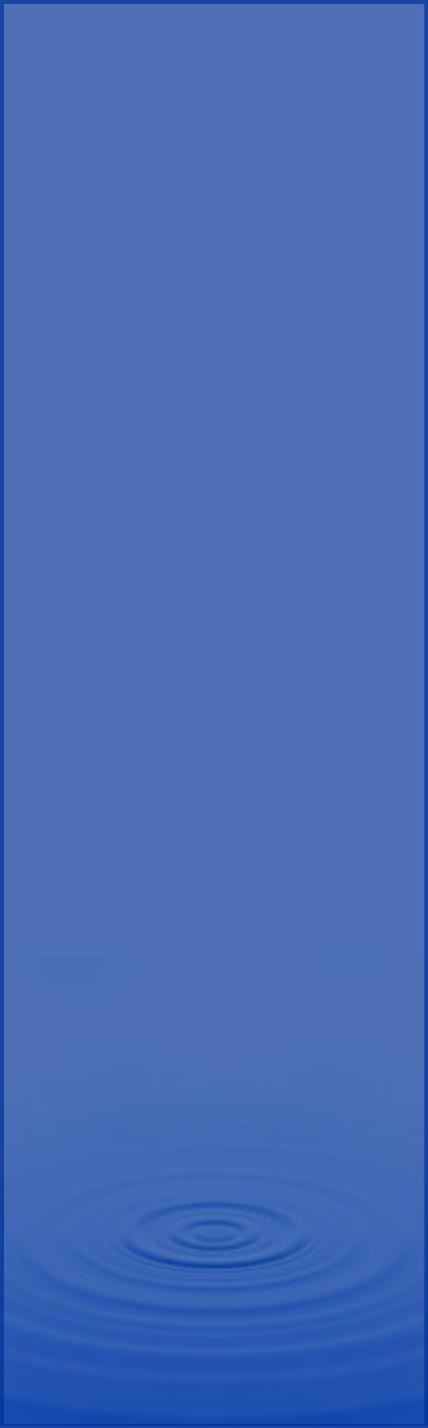
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# Project Design Principles

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- Teams are the center of learning, decision-making, and adaptation. **Human Attention** is a critical resource to be optimized: we recognize limits and strengths. Processes and tools can promote, or discourage, human engagement.
- **More Knowledge, Less Detail.** Information is a reflection of a functional, healthy, shared situational awareness. The knowledge has integrity as a result, not as a prerequisite. It emerges and evolves.
- **Expose Gaps at Conversation Speed** between hoped for targets and feasible reality. Prototype and fail the project early.
- Design of **shared activity is a core competency** of high performance teams



# Questions?

MIT ESD.36 System Project  
Management

*Bryan R. Moser*



## The state of *Project Design* in 2012

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- *Recently, industrial and government programs designed ranged from \$2M to \$100M+ (project labor cost) and 9 months to 6 years in duration*
- Current pace is design of 40 industrial projects per year and increasing
- Most programs are multi-national and cross-functional
- Various Sectors: Industrial Machinery, Equipment, Aerospace, Energy, and Automotive, I.T., and Services
- GPD collaborating with University Graduate Programs in Complex Engineering and Management to introduce courses on Project Design



# Simulation Forecasts Real-World Aspects

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- Analyzes coordination effort & costs
  - The “missing half” of effort and costs critical to 21st century projects
  - Proprietary agent-based, discrete event system with Monte-Carlo
  
- Real-world behavior & uncertainty
  - Concurrent & mutual dependence
  - Team communication, travel, meetings, time-zones...
  - Propagating impacts of decision delays, quality, & re-work
  - Constraints of team distribution
  
- Detailed output from hi-level input
  - **35%+ more accurate** forecasts & guides to improvement
  - **Validated** from years of research and industrial projects
  - Simulation factors can be toggled, adjusted and fine tuned



## Too little coordination kills projects. So does too much.

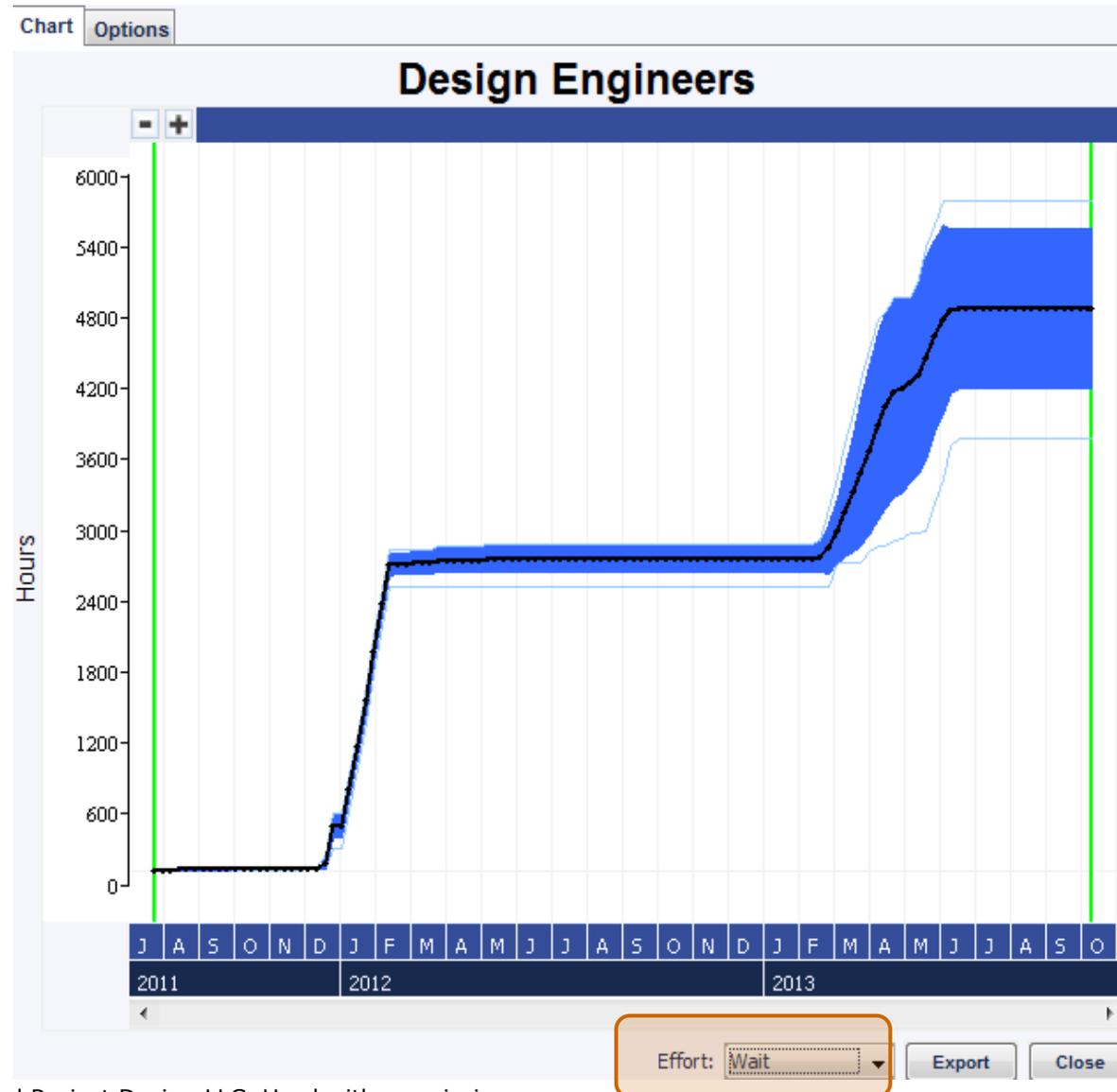
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- Teams coordinate to **satisfy dependencies**
  - Coordination doesn't mean simply holding meetings, reviews, and gateways
- Coordination is a lever to **eliminate rework** and influence teams to proceed at proper speed
- **Too fast** and mistakes are made.
- **Too slow** and parts that didn't need to be gold plated end up being solid gold



# Utilization Estimates Include Variance

- Range of **utilization** by different kinds of activity:
  - Primary & Assisting Work
  - Quality & Re-work
  - Coordination, Meetings, Travel..
  - Wait
- Opportunities to adjust the, **reduce waste**, and share resources emerge
- As change occurs, **demand shifts** across activities and teams.
- New forecasts are **easily generated** and inform the portfolio view.



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# Dealing with Uncertainty

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- Project Design pushes teams to **think and work through** issues up front, across many scenarios.
- Comparison of scenarios helps teams to characterize a **feasibility frontier with trade-offs**.
- Some unexpected variation is due to **misalignment** of teams – waste is reduced from awareness generated through the exercises.
- Once a project model exists, teams dealing with **unforeseen uncertainties** are capable of **rapid response** together

Image removed due to copyright restrictions.

*NASA's Apollo 13 team in Mission Control Center. How was this team able to adapt and respond so quickly, without the sorts of IT systems and planning tools today?*



# Project Risk: Integrated Assessment and Mitigation

## ➤ Risk as part of Project Design

- Extrinsic Project risks identified and mitigated earlier
- Clear ownership and accountability
- Systemic impact on total schedule, cost, and quality

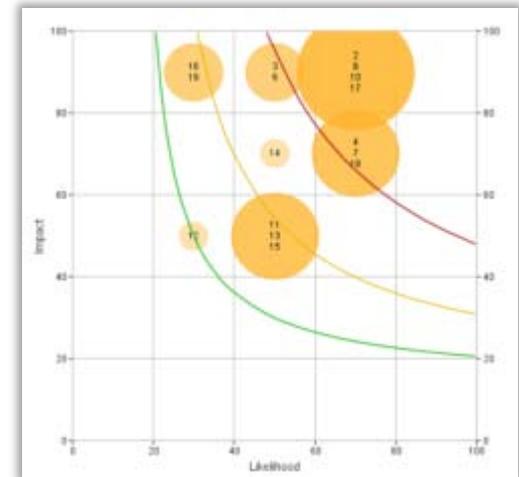
## ➤ Ongoing Mitigation integrated with Plan

- Real activity: capacity and coordination trade-off
- Waterfall shows actual mitigation against plan
- Part of a natural, ongoing dialogue

## ➤ Awareness early and sustained throughout

- Practical – no longer the domain of experts

Risk Matrix



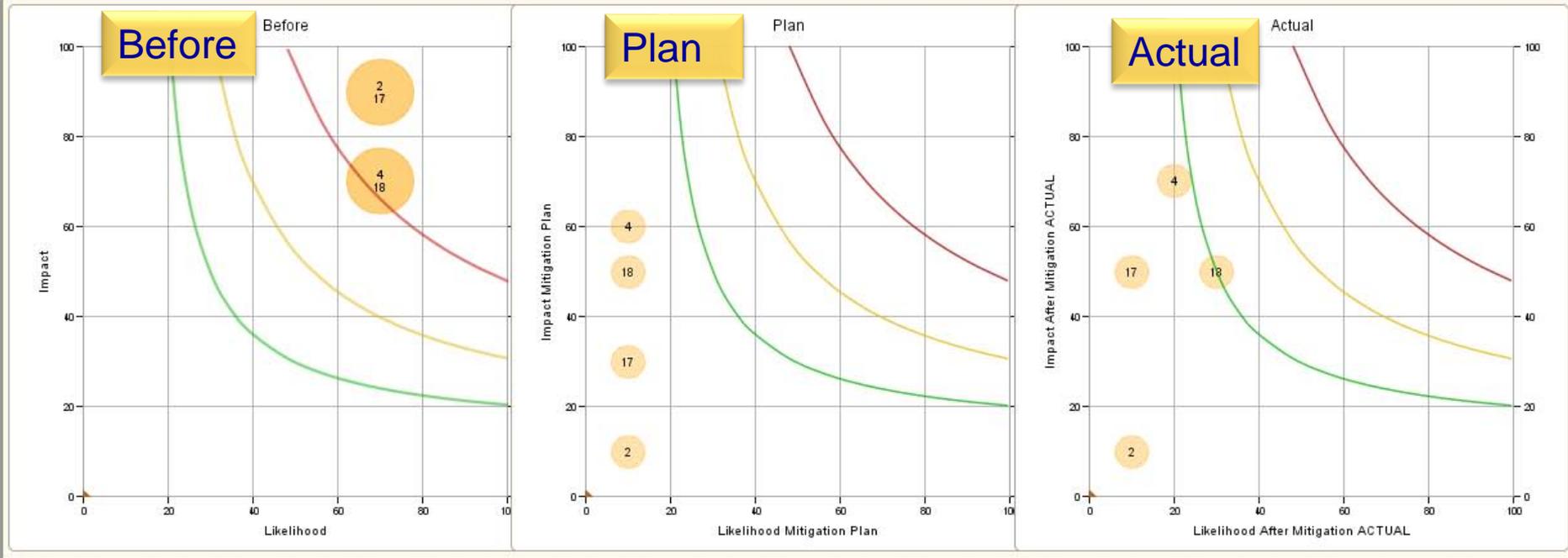
Mitigation Waterfall



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# Risks Matrices



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# Speaker

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## **Dr. Bryan R. Moser**

*Global Project Design (GPD)*

*University of Tokyo, Future Center*

- Bryan is founder and CEO of GPD, a company transforming teamwork to match the complex nature of work today. As a researcher from 1994-1999 at the University of Tokyo he pushed forward methods and cases for high performance global teaming. For a decade with United Technologies, Bryan led technology development partnerships and complex programs in Asia, creating strategic collaboration with industries, universities and national programs. In the late 1980's Bryan was one of the first foreign engineers at Nissan in Japan.
- Bryan earned a doctorate in the Graduate School of Frontier Sciences at the University of Tokyo, where he now leads multi-disciplinary research on complex socio-technical systems. He also has degrees in Computer Science and Technology & Policy both from MIT, where he received the Karl Taylor Compton Award, Hugh Hampton Young Fellowship and Alumni Award for Excellence in Technology and Policy.



## Research Background

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- “These case studies show that small architectural impacts may lead to surprising outcomes when activities are moved from local to global contexts. From each team’s perspective, the way that the integrated architecture generates demand for work and coordination may appear in combinations inconsistent with the team’s local work culture. The design of the project may unknowingly disrupt the potential of embedded practices, abilities, and knowledge. If a team’s local work culture acts as an organizing driver to decrease uncertainty (information entropy) in the integrated socio-technical system over time, a surprising sudden shift in various demands and costs of coordination will increase uncertainty. In global projects a small change to alignment of the team’s abilities (supply) to the need for work and coordination (demands) can lead these very same embedded practices to be wasted or, moreover, trigger unexpected delay, poor quality, and propagating rework. A team unaware of these unexpected impacts -- following their own best judgment -- may in fact be a cause of systemic poor performance. In these cases, given the counterintuitive root cause of these difficulties, teams in frustration may harden their beliefs (思い込み), instead assuming that the cause of difficulty must be the behaviors of other teams.”

Moser 2012, “The Design of Global Work: Simulation of Performance Including Unexpected Impacts of Coordination across Project Architecture”

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Fall 2012

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