
Identifying and Mitigating Risk Across Organizational Boundaries In Software-intensive Space System Programs

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March 29, 2006

Agenda

- **Presenting problem & definition**
- **Two baseline model (SPO and Contractor)**
- **Four baseline model (SPO, Contractor, Sub, and Vendor)**
- **Partial research findings**
 - Simulation results from key scenarios
 - Points of leverage
 - Boundary Objects what they are and why they matter
- **Summary**

Presenting Problem

How to maintain alignment between the SPO-approved and contractor's baselines?

Definition

“Disconnects” are latent differences in understanding among groups that can negatively affect the program should they remain undetected or unresolved.



Disconnects meet “Wicked Problem”¹ criteria²

- The problem is an evolving set of interlocking issues and constraints
- There is no definitive statement of the problem
- You don't understand the problem until you have developed a solution
- ***Many stakeholders care about how the problem is resolved, making the problem solving process fundamentally social***
- ***Getting the “right answer” is less important than obtaining the stakeholders’ acceptance of the emerging solution***
- Solution constraints (e.g. resources and political ramifications) change over time
- Stakeholder constraints change due to: stakeholder turnover, changed opinions, failure to communicate, or other rule changes by which the problem must be solved
- Since there is no definitive problem, there is no definitive solution
- ***The problem-solving process ends when you run out of time, money, energy, or some other resource, not when some perfect solution emerges***

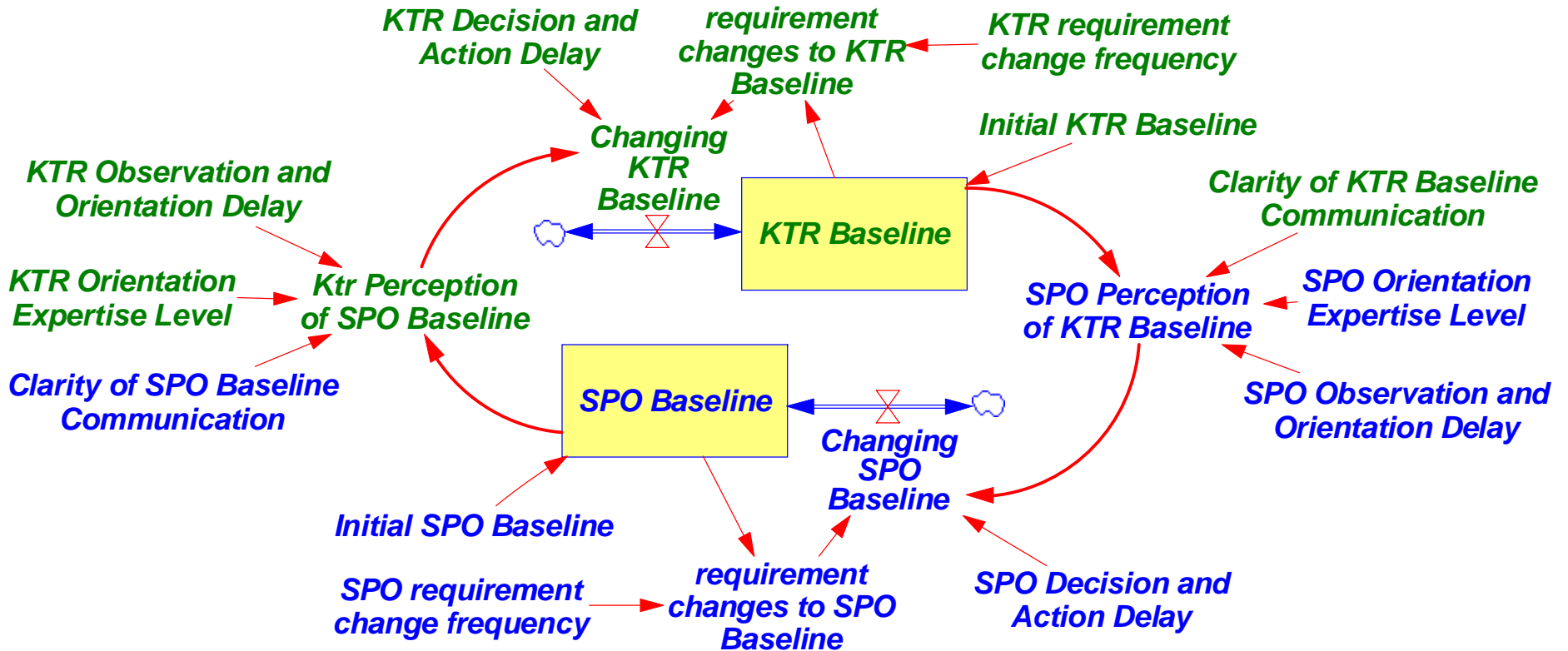
¹ Rittel, H. and M. Webber; “Dilemmas in a General Theory of Planning” pp 155-169, *Policy Sciences*, 4, 1973

² Adapted from: http://www.3m.com/meetingnetwork/readingroom/gdss_wicked.html



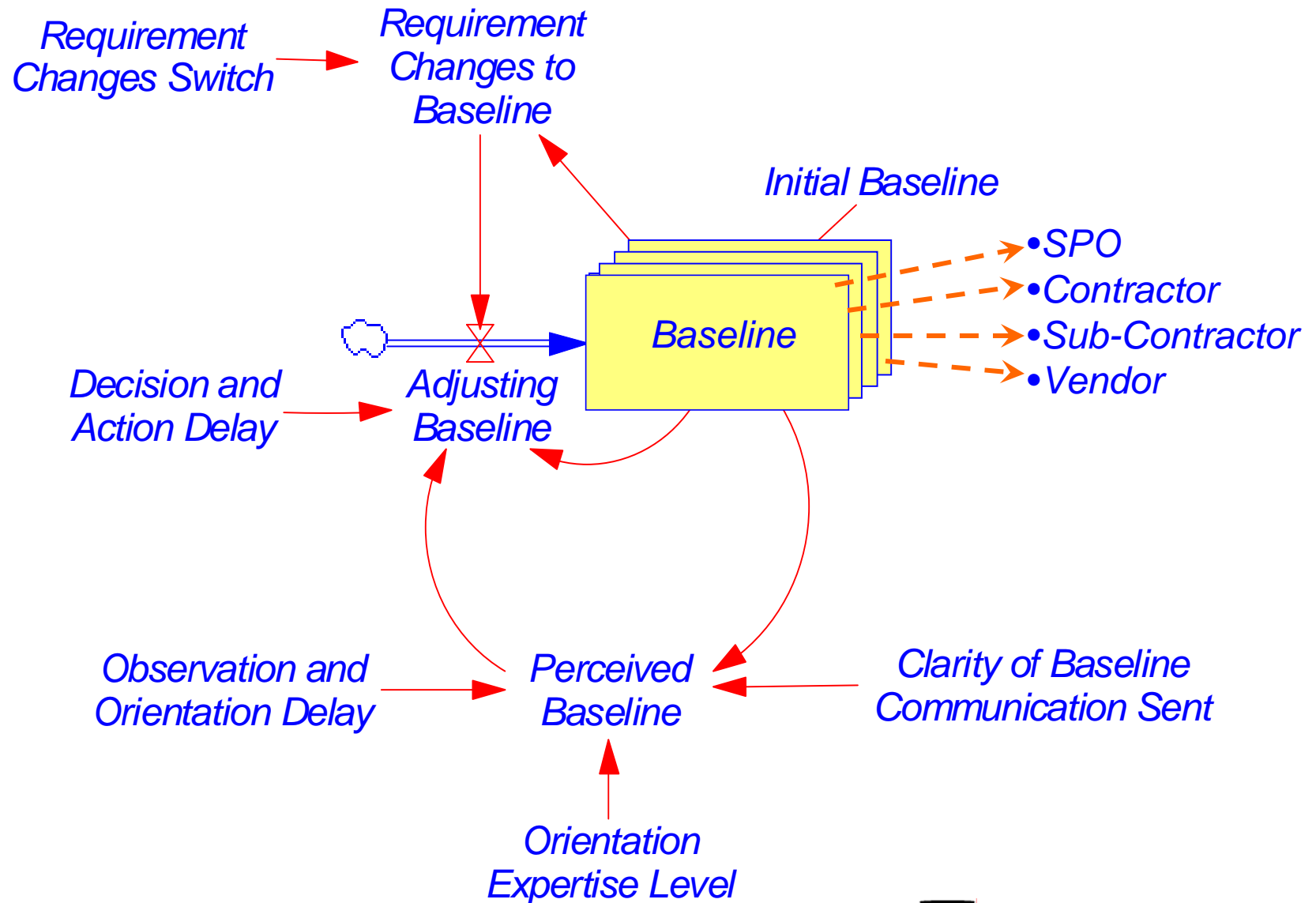
Created a SPO-Contractor Interaction Model

KTR = Contractor
 SPO = System Program Office



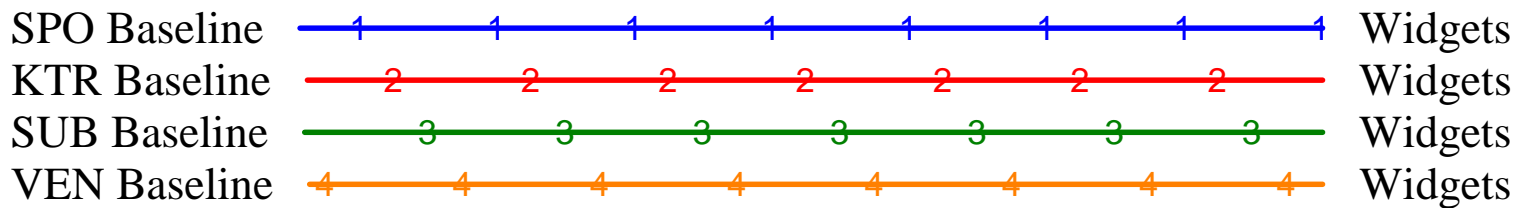
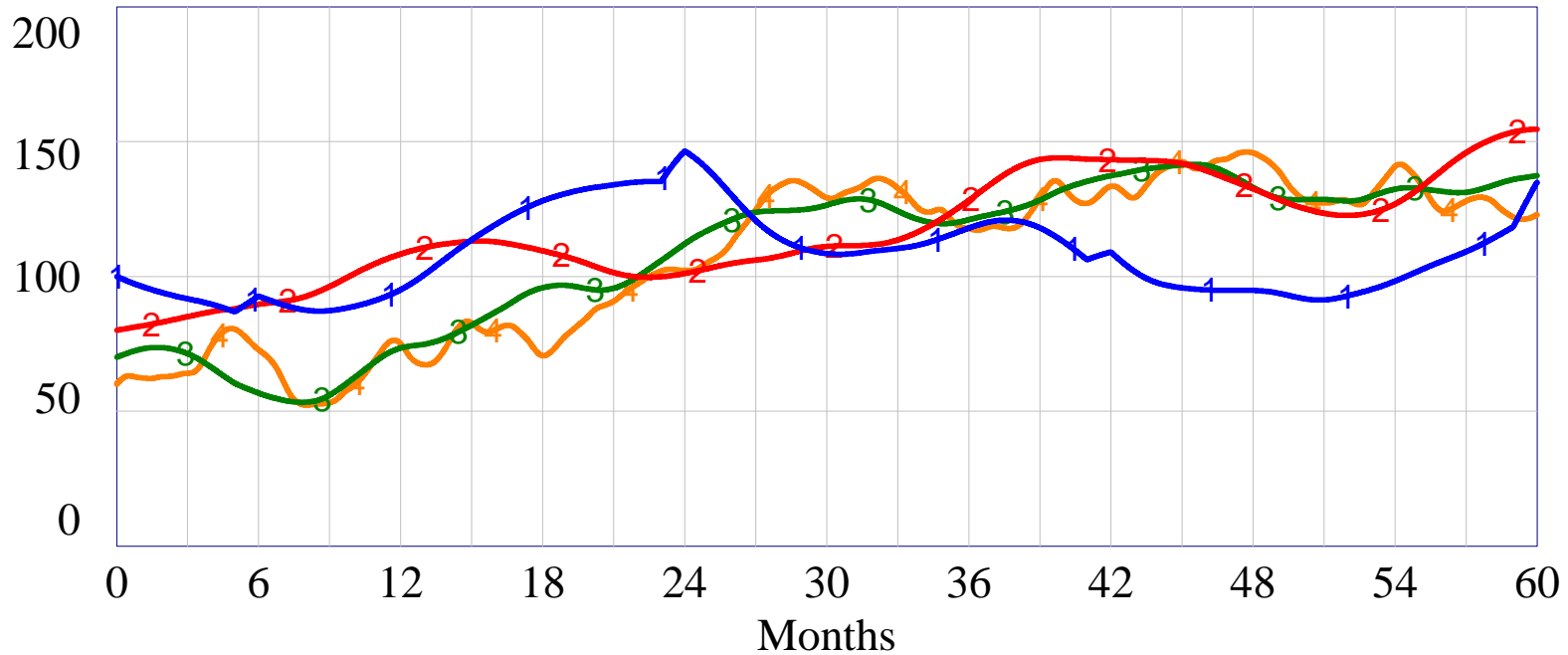
These relationships create a dual floating-goal structure

Expanded the Interaction Model to Four Players



Base Case

Government and Contractor Baselines



- **Disconnect index 2529**

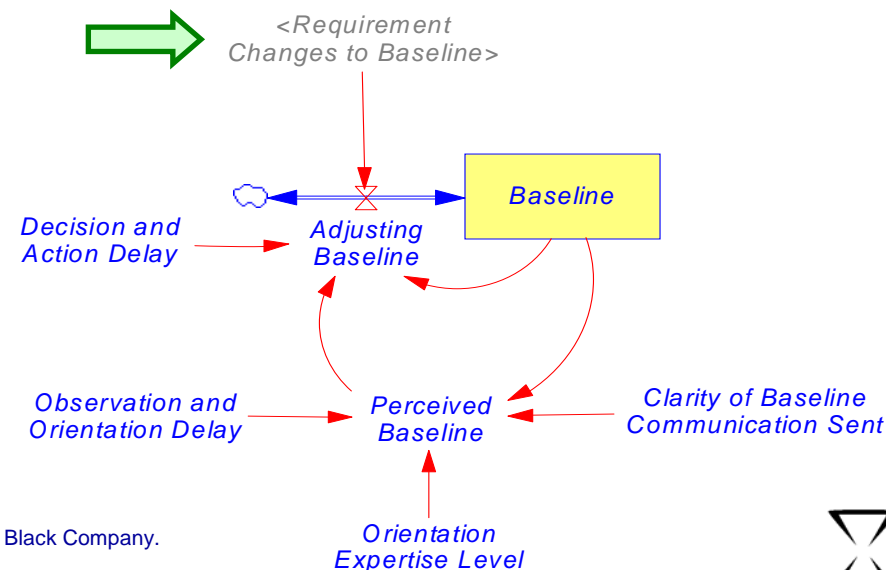


Scenario A:

Turning Off the “Requirements Grenade”

Interviews revealed beliefs that disconnects arise from “out there”—because external stakeholders change requirements

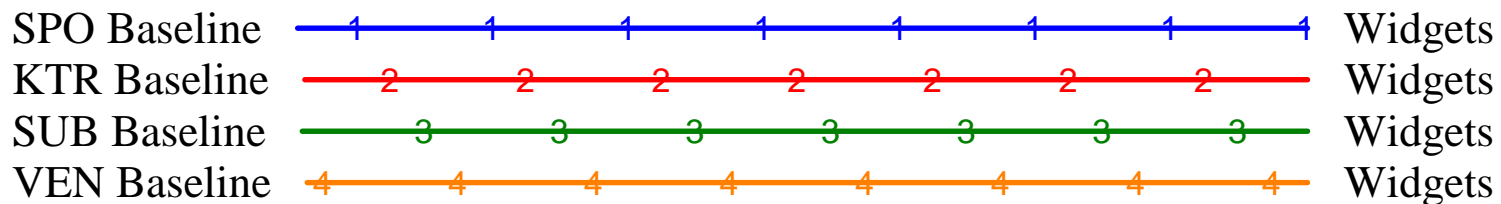
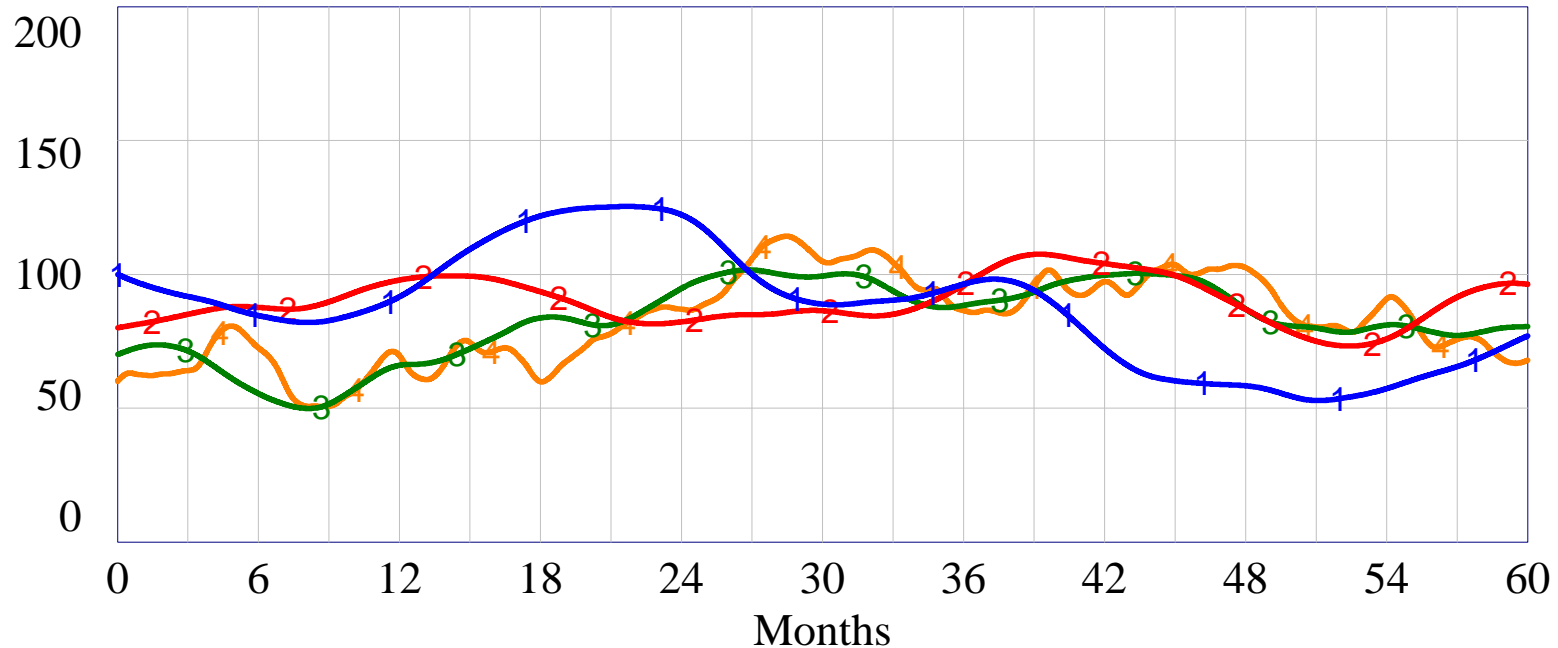
- **Scenario A: Turn the *Requirement Changes Switch* “off” (No party receives external requirements changes)**



Scenario A:

Turning Off the "Requirements Grenade"

Government and Contractor Baselines



- **Disconnect index 2288—only a 9.5% improvement**

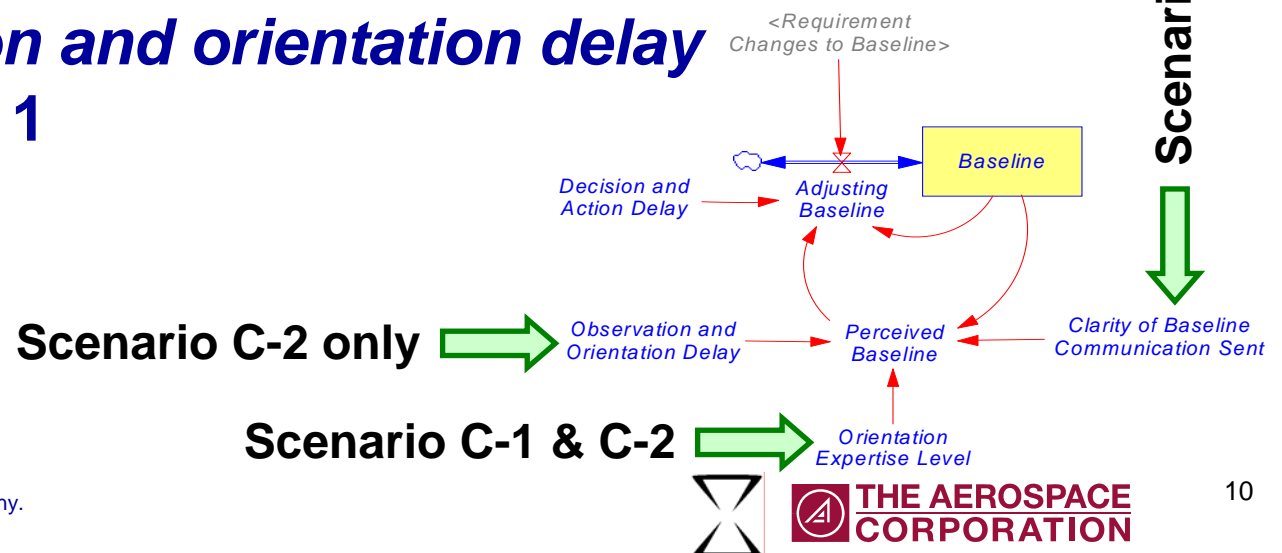


Scenario C:

Points of Leverage in Reducing Disconnects

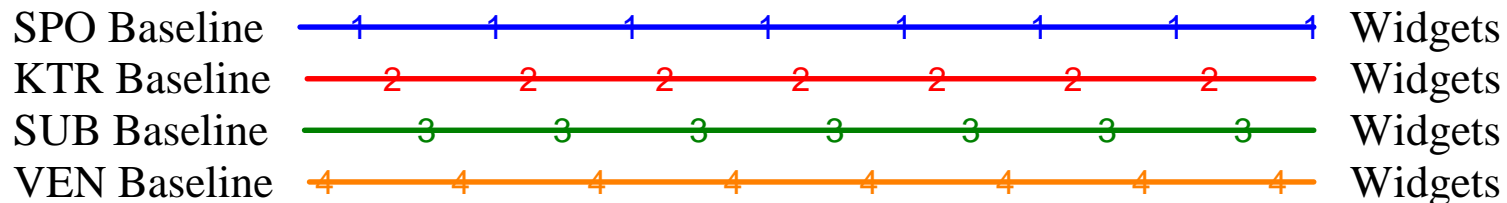
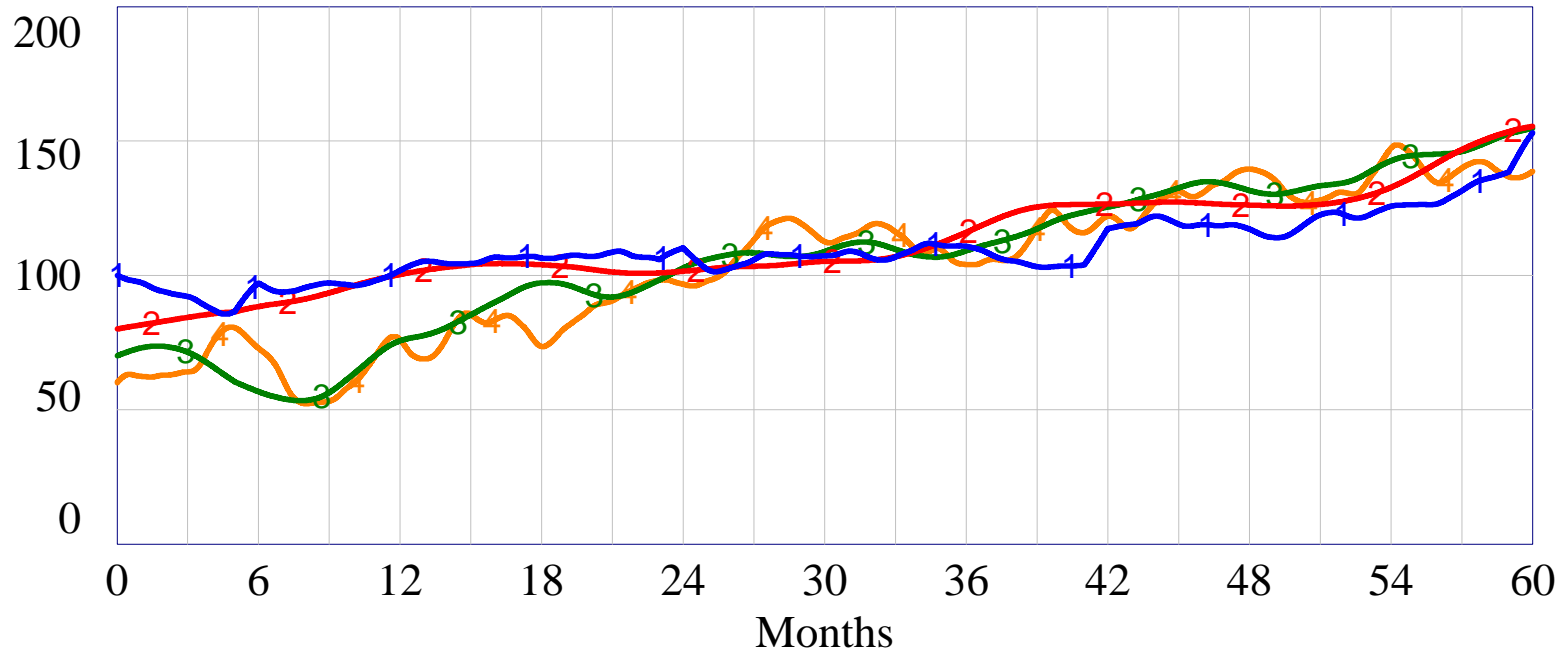
The research team ran a variety of scenarios focused on reducing the duration and magnitude of disconnects

- **Scenario C-1:** Increases the SPO's *orientation expertise level* from 0.5 to 0.75 and increases *clarity of communication sent* from 0.6 to 0.9
- **Scenario C-2:** Same as C-1 and reduces the SPO's *observation and orientation delay* from 5 months to 1



Scenario C-2: Reducing Disconnects— Higher Expertise, Greater Clarity, Faster Observation and Orientation

Government and Contractor Baselines



- Disconnect index 1409—a 44.3% improvement**

Partial research findings

- Solving “wicked problems,” such as disconnects, requires a problem-solving approach that is primarily social
- Changing how knowledge is represented in “boundary objects” improves performance at primary leverage points

What is a “Boundary Object³”?

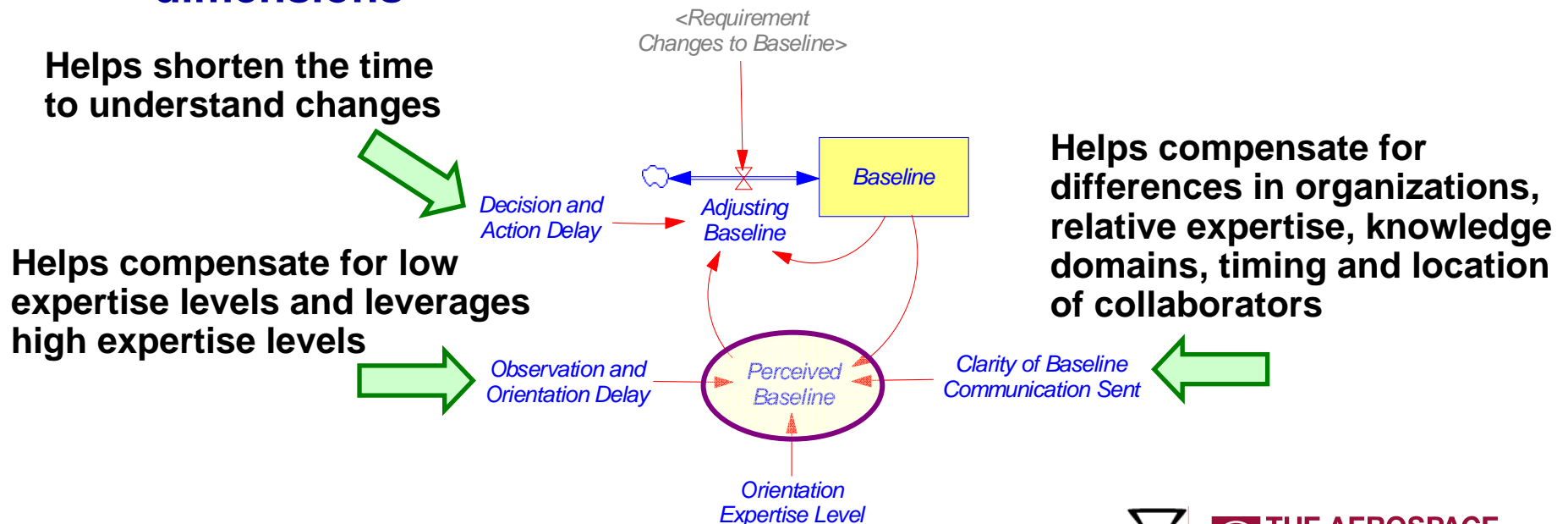
- A boundary object is an artifact (or sometimes a person) that enables individuals to collaborate effectively across some form of boundary
- Boundaries are gaps or differences in organization structures or entities, political power, relative expertise, knowledge domains, timing, and/or locations among the players
- The artifact represents key dependencies (dimensions of shared interest) among the players
- It is an “impoverished replica” of the salient shared dependencies
- To be a boundary object (not a bludgeoning tool) the artifact must be transformable by all parties involved in the collaboration

³ Star, S.L. and J.R. Griesemer, “Institutional Ecology, ‘Translations’ and Boundary Objects: Amateurs and Professionals in Berkeley’s Museum of Vertebrate Zoology, 1907-39,” *Social Studies of Science*, 19, 1989. See also Henderson, K., “Flexible Sketches and Inflexible Data Bases: Visual Communication, Conscription Devices, and Boundary Objects in Design Engineering,” *Science, Technology & Human Values*, 16 (4), 1991, and Carlile, P.R. “A Pragmatic View of Knowledge and Boundaries: Boundary Objects in New Product Development,” *Organization Science*, 13 (4), 2002.



“Boundary Objects” Provide Leverage

- **Leverage points identified in the simulated world**
 - Increase the collective expertise brought to bear when assessing change (orientation expertise level)
 - Increase clarity of communication
 - Reduce the sense-making time required for a change (observation and orientation delay)
- **Knowledge represented in “boundary objects” address all three dimensions**



Summary

- **Disconnects are caused by ineffective and slow social construction of solutions, not changing requirements**
- **Rapid program-wide sense making of change is critical because...**
- **Disconnects become wicked problems when they are not promptly resolved**
- **Boundary objects are a significant point of leverage to enable improved collaborative performance**
- **Programs must accept responsibility for how quickly and effectively they socially construct solutions**

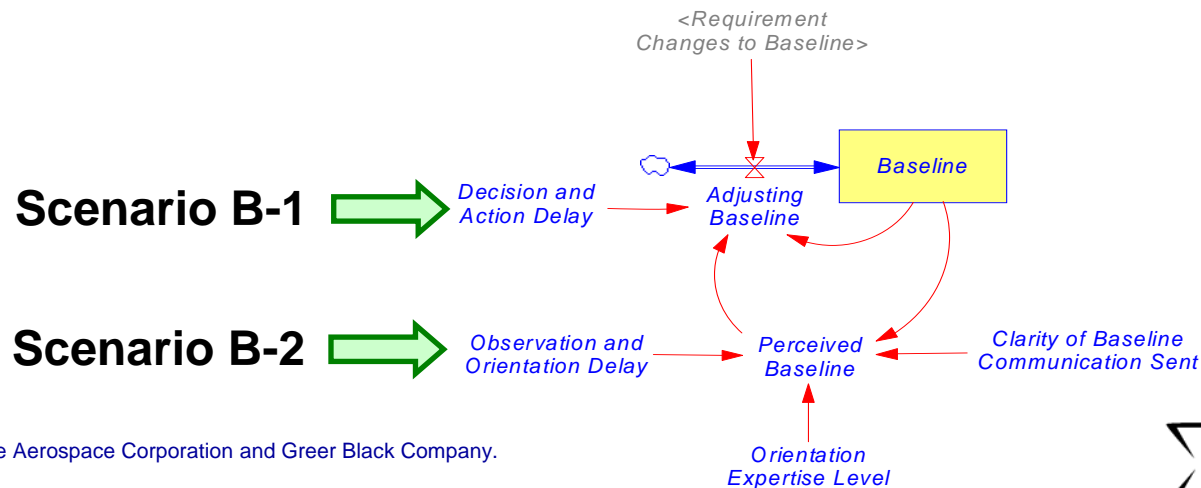


Backup Charts

Scenario B: *Speeding Up the SPO*

Interviews revealed beliefs that, if the SPO decided and acted more quickly, fewer disconnects would result

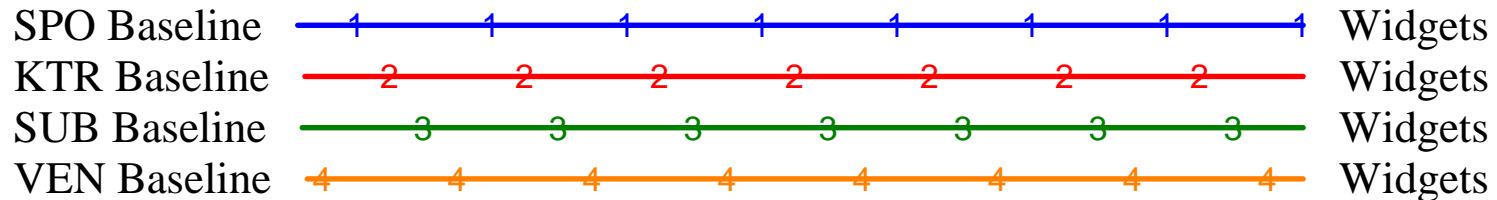
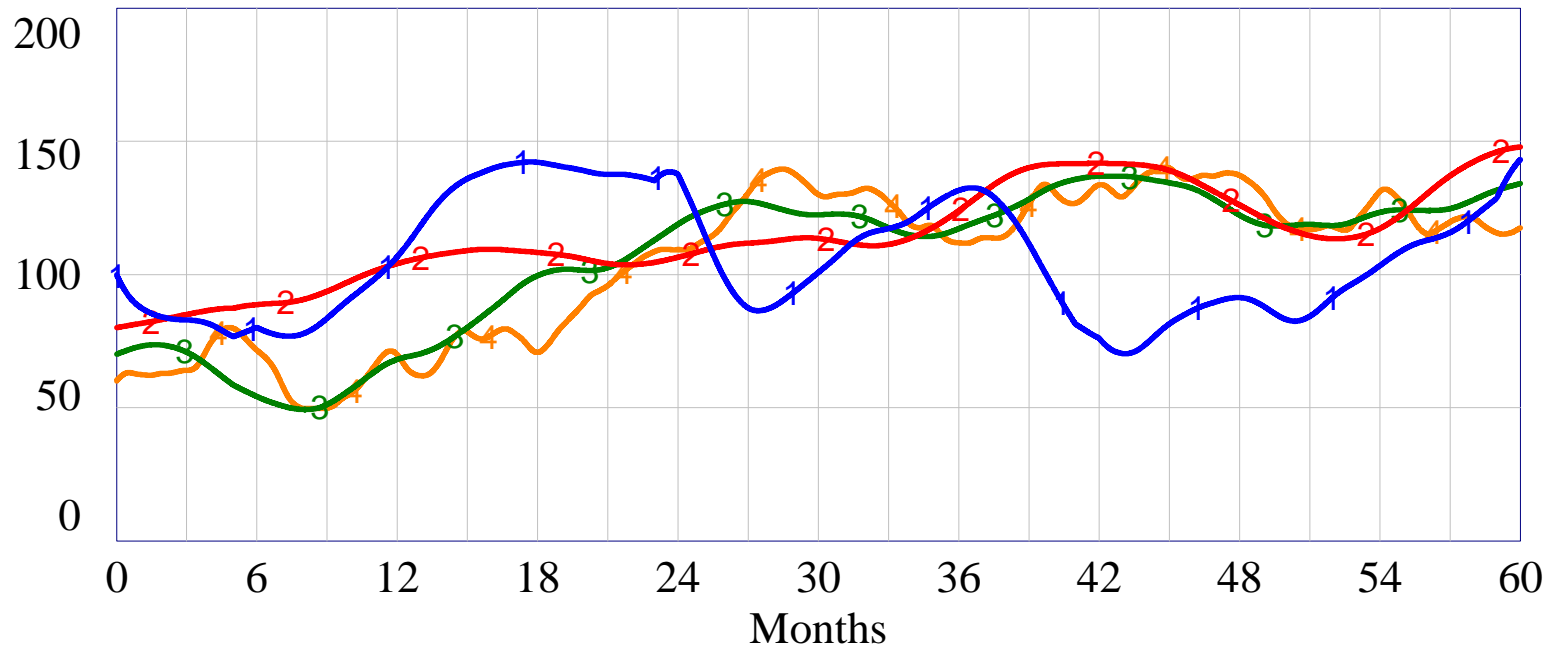
- **Scenario B-1: Reduces the SPO's *decision and action delay* from 5 months to 1**
- **Scenario B-2: Reduces the SPO's *observation and orientation delay* from 5 months to 1**



Scenario B-1:

Speeding Up the SPO—Accelerating Decision and Action

Government and Contractor Baselines

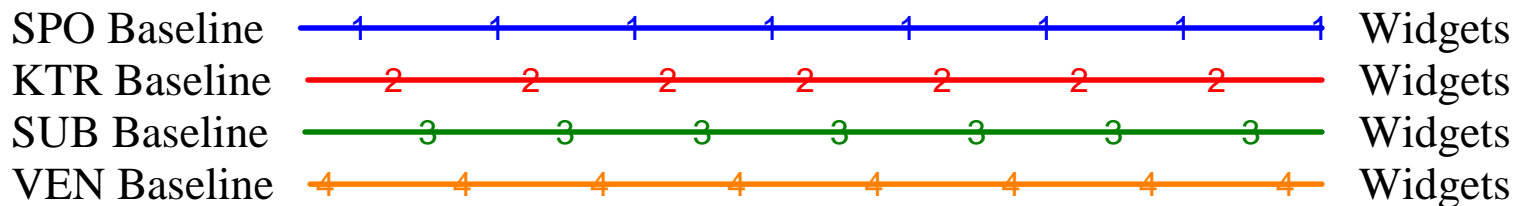
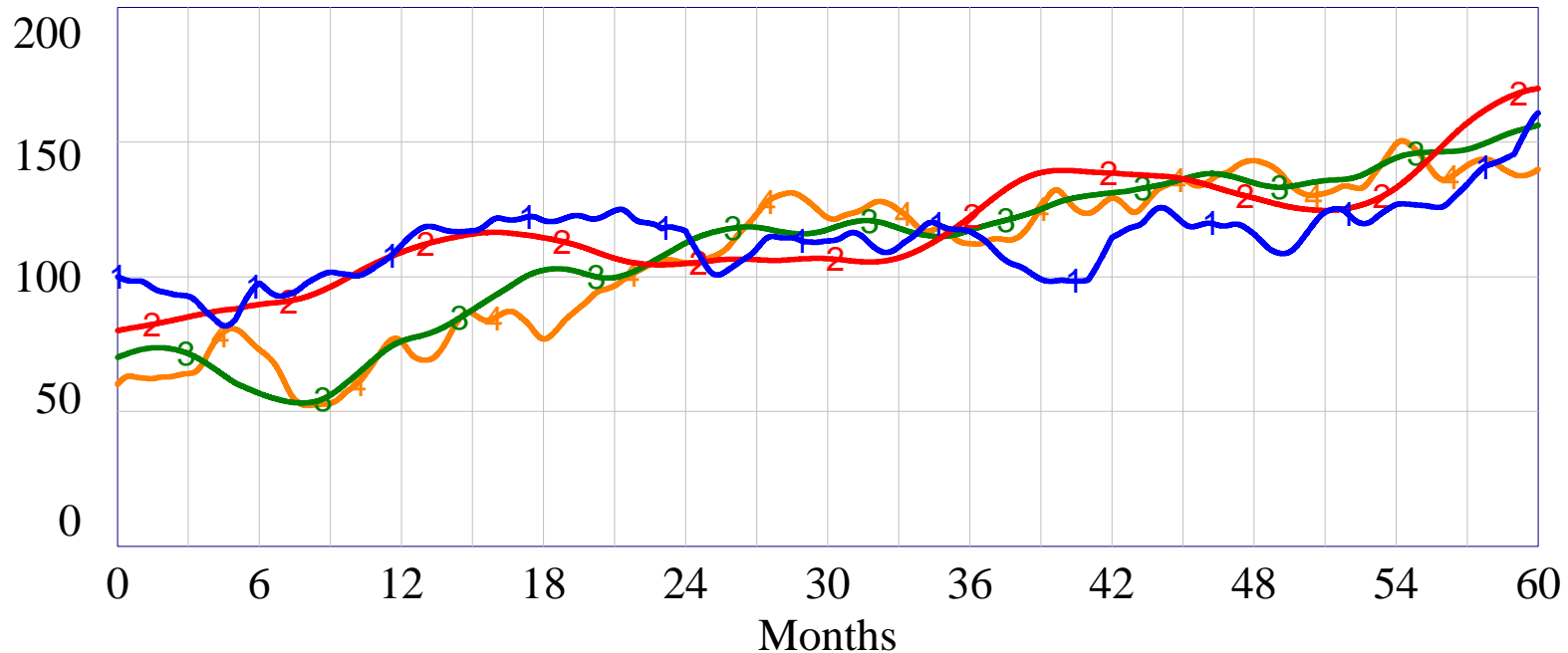


- **Disconnect index 2635—a 4.2% deterioration**

Scenario B-2:

Speeding Up the SPO—Accelerating Observation and Orientation

Government and Contractor Baselines



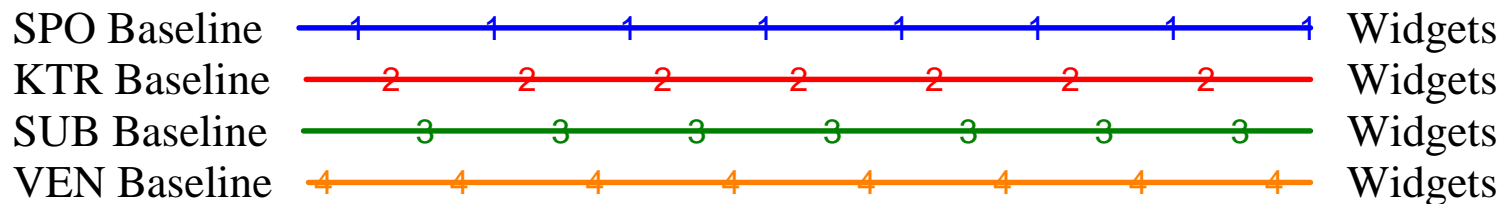
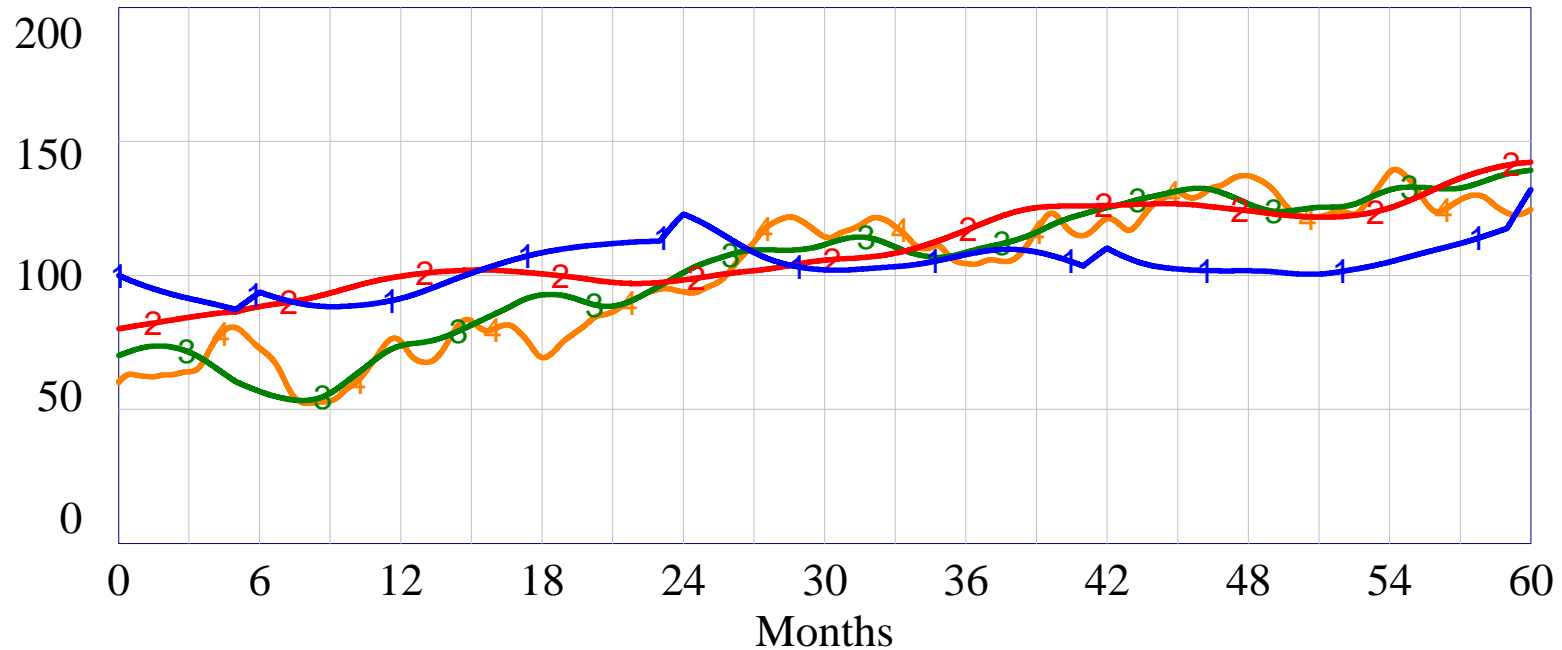
- **Disconnect index 1918—a 24.1% improvement**



Scenario C-1:

Reducing Disconnects—Higher Expertise and Greater Clarity

Government and Contractor Baselines



- **Disconnect index 1717—a 32.1% improvement**