

Modeling and Simulation

More Critical Than Ever in a Challenging
Environment



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October 2013

TOMORROW'S
SUCCESS
BEGINS TODAY

The Need for Modeling and Simulation

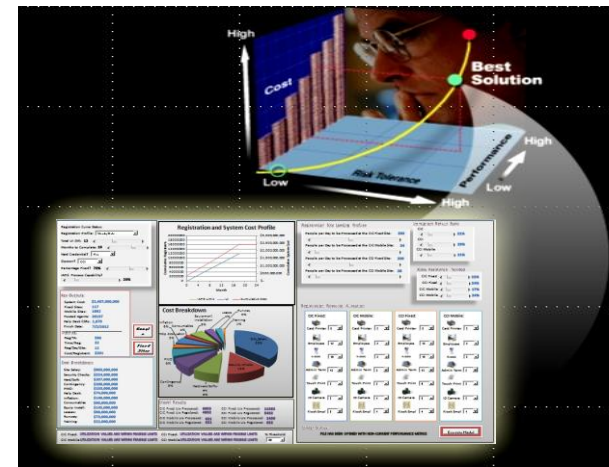


★ External Factors

- Increasing Mission Complexity
 - Rapid What-if Scenarios
- Declining Customer Budgets
- Drive Toward FFP Contracts
- Affordability
- Long Range Planning Challenges

★ Internal Factors

- Solution Credibility
- Program Execution Risk
- Affordability
- Design to Cost
- Dispersed Workforces

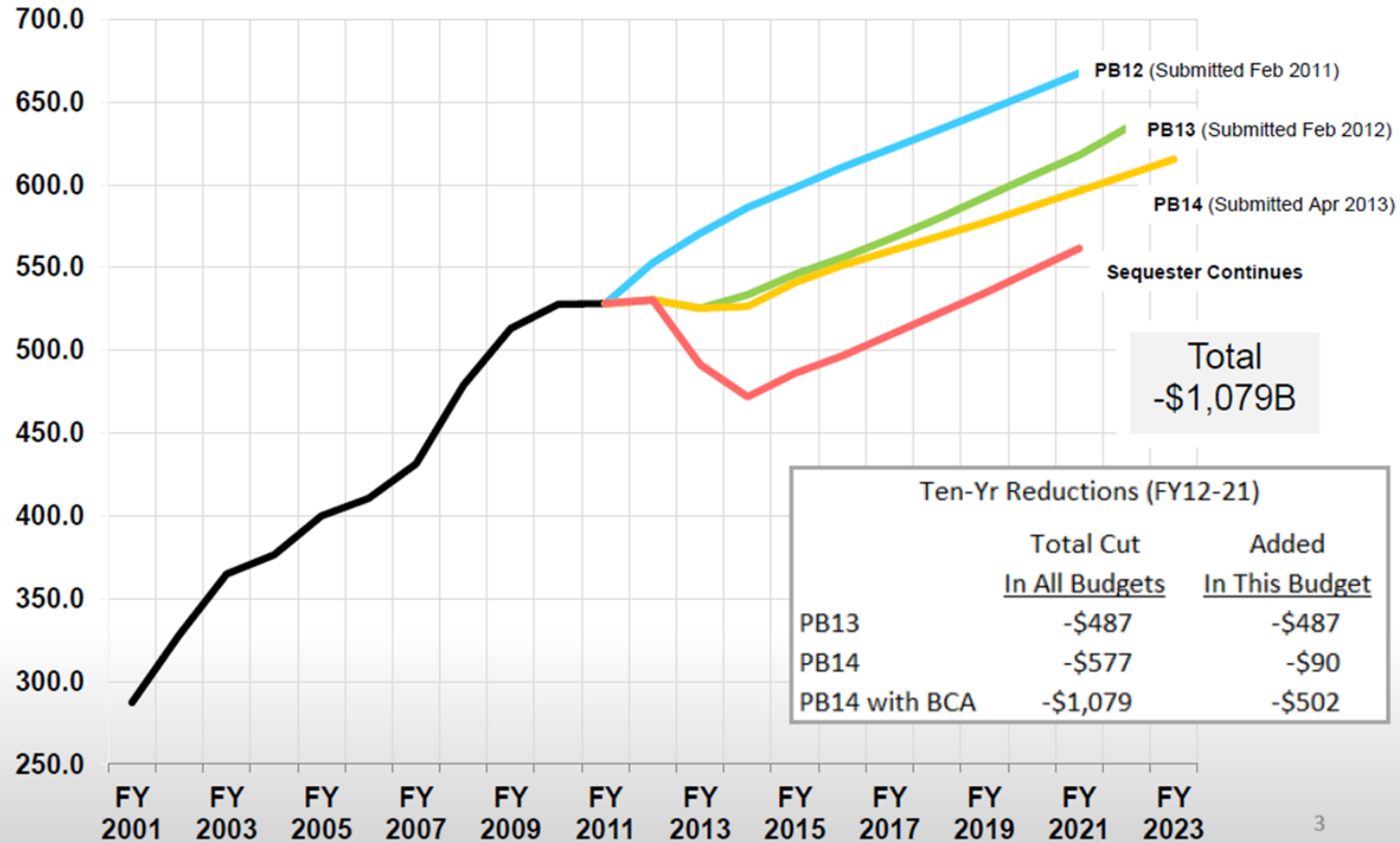


DOD Budget Outlook



Defense Budgets Past and Future (Base Budget)

Then Year Dollars, Billions
Discretionary Budget Authority





Modeling and Simulation Applications

- ★ Metric/Statistical Models

- IT Services Optimizations
- IT Transformations

- ★ Business Process Modeling

- Manufacturing Line Process Flows (Discrete Event)

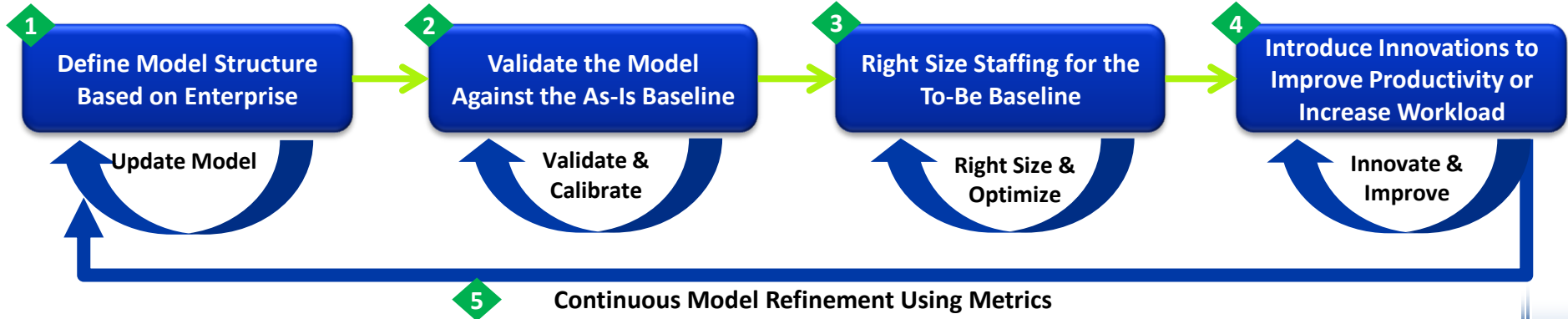
- ★ Sustainment System Affordability Models

- Integrated Logistics Affordability Optimizations

- ★ Mission Performance Models

- Global Communications Modeling

Rapid Modeling and Simulation Methodology



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- ❖ The Approach is Not Trivial...But it is Repeatable
- ❖ It Requires Skilled Staff to Implement
- ❖ It Provides Cost Estimation Credibility...And Supports Ongoing Enterprise Analysis

Problem Complexity



★ Why not prototype?

- Prototypes can be very expensive and may not accurately simulate the system
- Access to the systems' inputs and outputs may be difficult to achieve or be non-existent
- Limited Availability to conduct What-if Analyses

★ Customer Mission Complexity is Rapidly Increasing

- Assets that support these missions are growing more complex at an equal or faster rate

★ Degrees of Variation are too broad for traditional methods to work

★ Optimized is in the eye of the Beholder

- Customer priorities, contractual requirements, budgets

Discover Hidden Performance Optimizations Through M&S and Expert Analyses

Enterprise IT Workflow Case Study



★ Challenge

- Maintain or Exceed SLA performance while simultaneously increasing productivity and reducing cost

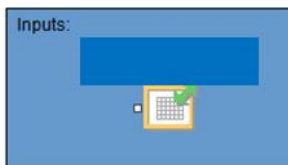
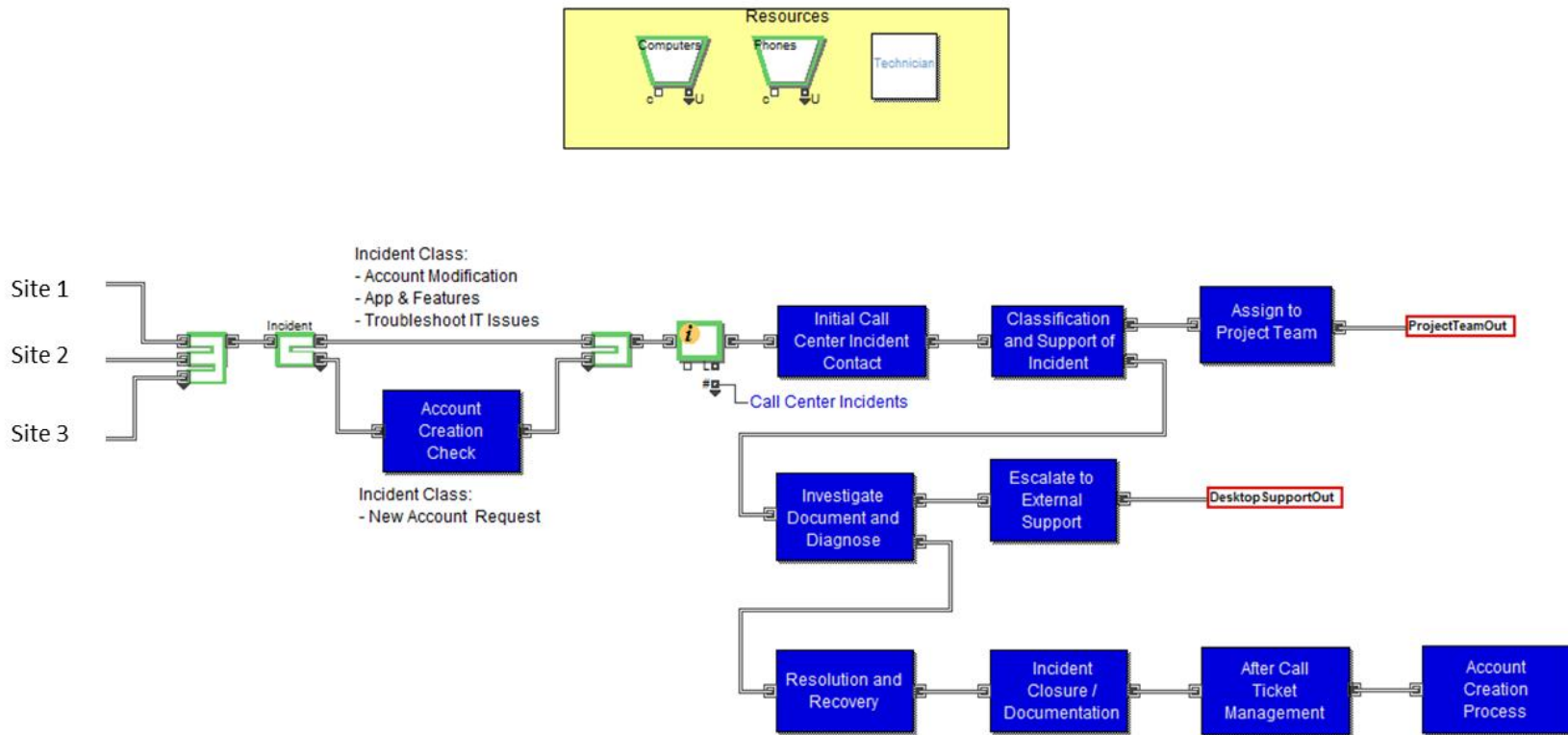
★ Approach

- Model Specific Enterprise Workflows
- Validate
- Apply Business Innovations
- Optimize on Customer Best Value

★ Result

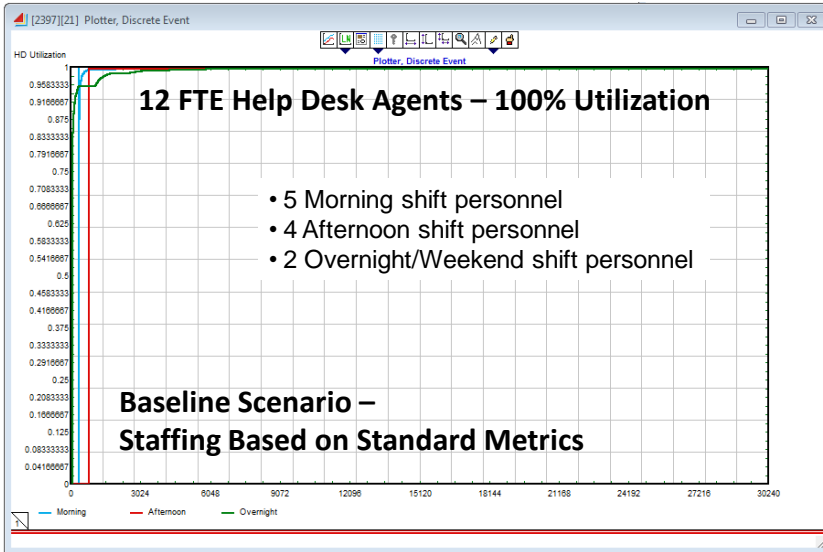
- 58% Cost Takeout

Enterprise IT Workflow Case Study





Simulation Output Analysis – Help Desk



$$\pi(50) = \frac{E[s]}{c(1-\rho)} \ln\left(\frac{100C(c,u,\rho)}{100-50}\right)$$

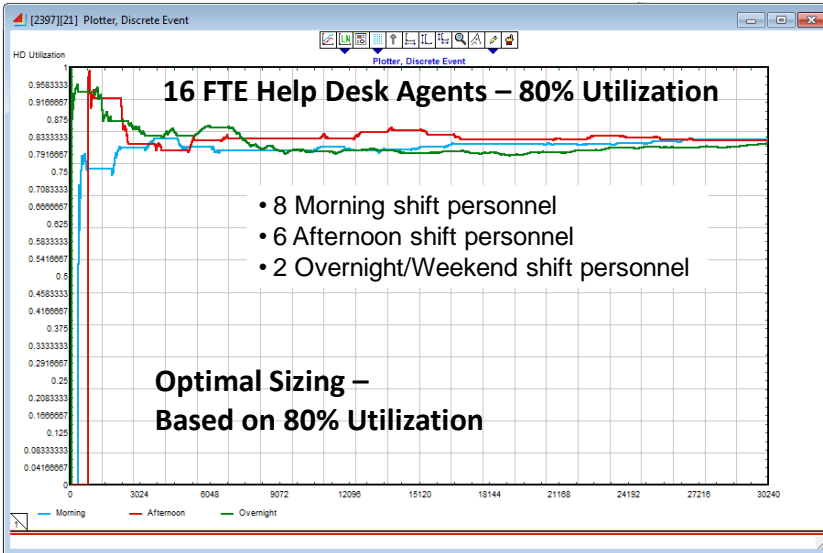
Median Call Answer Time: 1.1 Hour

Understaffed



$$\pi(90) = \frac{E[s]}{c(1-\rho)} \ln\left(\frac{100C(c,u,\rho)}{100-90}\right)$$

90% Call Answer Time: 3.8 Hours



$$\pi(50) = \frac{E[s]}{c(1-\rho)} \ln\left(\frac{100C(c,u,\rho)}{100-50}\right)$$

Median Call Answer Time: 42 Seconds

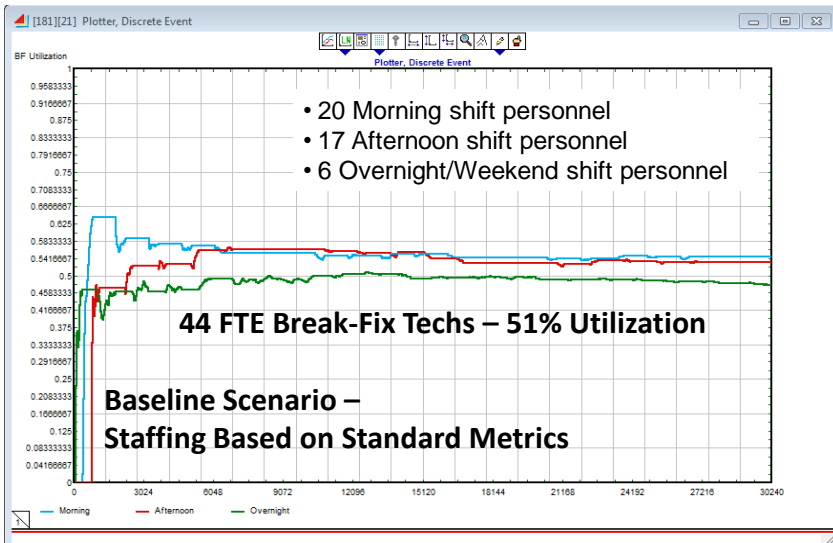
Optimally Staffed



$$\pi(90) = \frac{E[s]}{c(1-\rho)} \ln\left(\frac{100C(c,u,\rho)}{100-90}\right)$$

90% Call Answer Time: 7.6 Minutes

Simulation Output Analysis – Break-Fix



$$\pi(50) = \frac{E[s]}{c(1-\rho)} \ln\left(\frac{100C(c,u,\rho)}{100-50}\right)$$

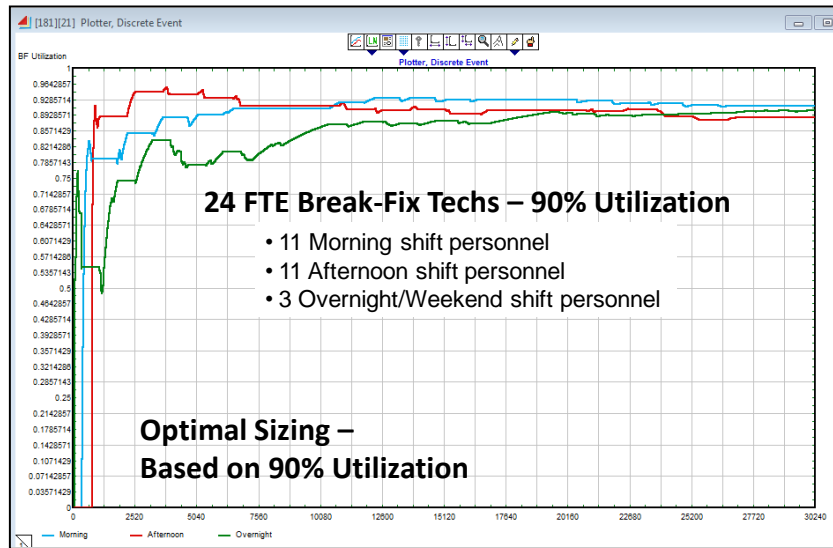
Median Return to Service: 1 Hour

Overstaffed



$$\pi(90) = \frac{E[s]}{c(1-\rho)} \ln\left(\frac{100C(c,u,\rho)}{100-90}\right)$$

90% Return to Service: 1 Hour



$$\pi(50) = \frac{E[s]}{c(1-\rho)} \ln\left(\frac{100C(c,u,\rho)}{100-50}\right)$$

Median Return to Service: 3.2 Hours

Optimally Staffed



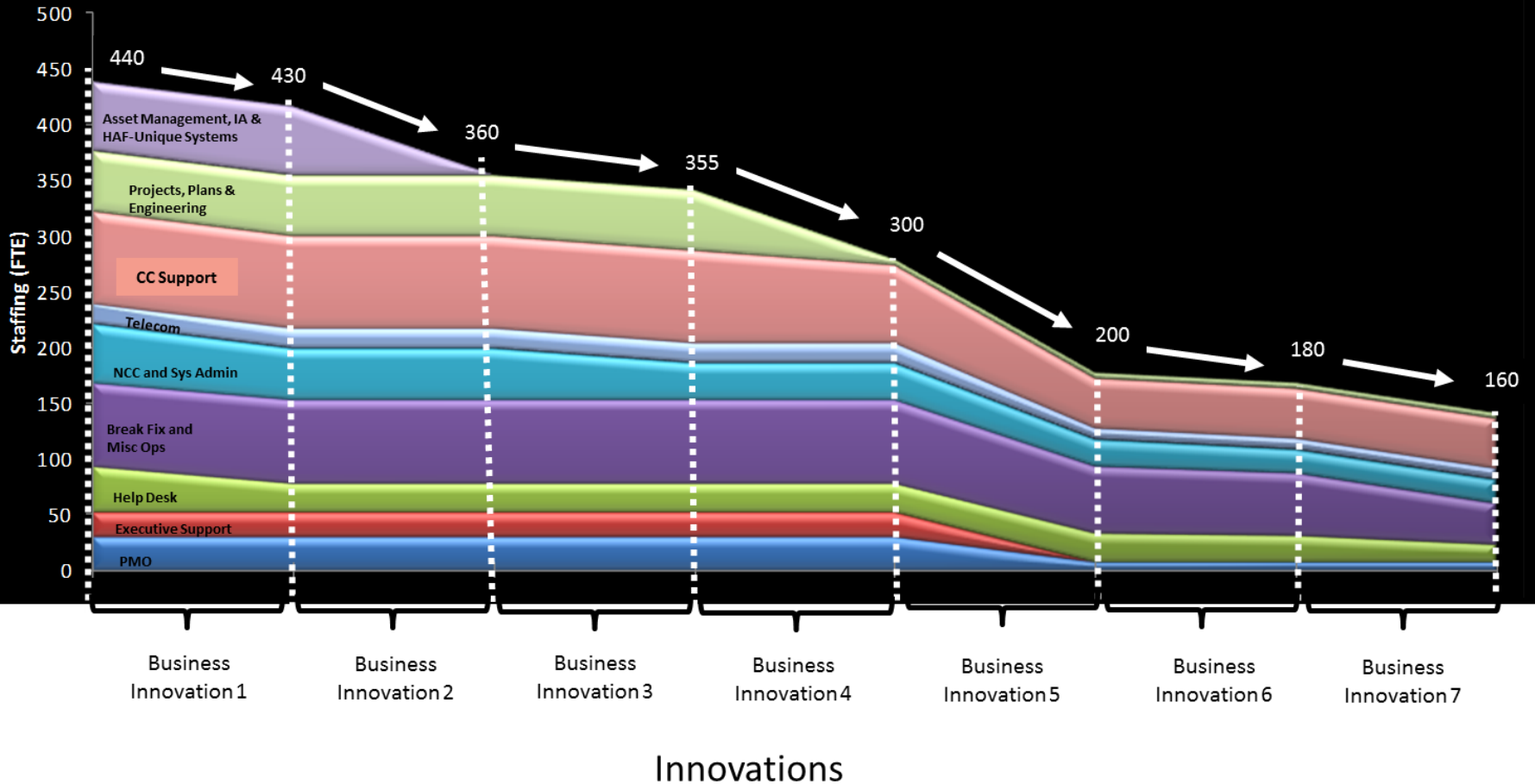
$$\pi(90) = \frac{E[s]}{c(1-\rho)} \ln\left(\frac{100C(c,u,\rho)}{100-90}\right)$$

90% Return to Service: 8.9 Hours

Innovation With Purpose



Design to Cost and Value Optimization



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Manufacturing Process Optimization Case Study



★ Challenge

- Can LNG tanks be produced at the right price points, and delivered on the required schedule
- Where are the productivity bottlenecks that prevent meeting the business objectives

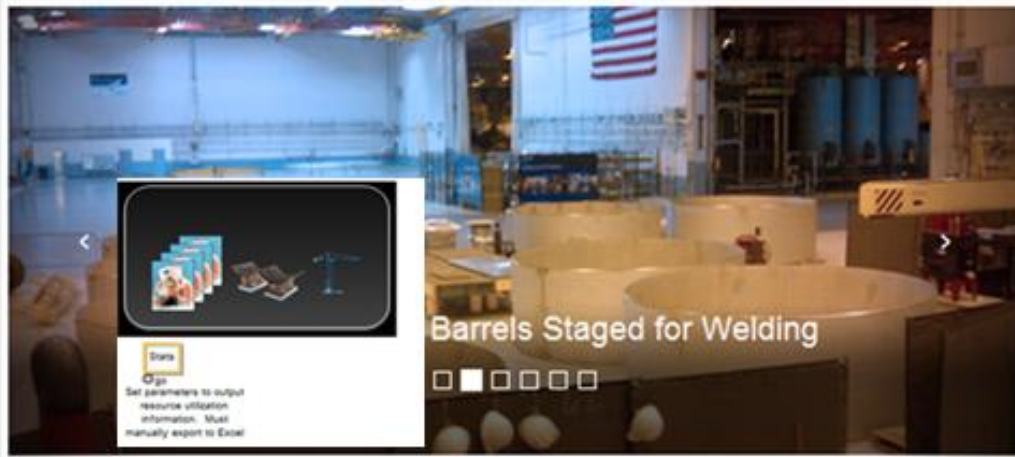
★ Approach

- Model the manufacturing line process detailing required resources, including human, capital, and facilities. Determine system throughput.
- Add a second processing line and update the models to include resource contention and evaluate impacts to throughput
- Develop an integrated labor/cost modeling tool for rapid ROM preparation

★ Result

- Rapid response to new orders
- Easily assess value to changes in the flow or adding additional capacity

Liquid Natural Gas Tank Manufacturing Model



General Information

Tank Properties

Volume = 400 [Unit]

Volume: 400 [Unit]

Length: 58.16

Diameter: 20

Tank Weight: 100 [Unit]

Other

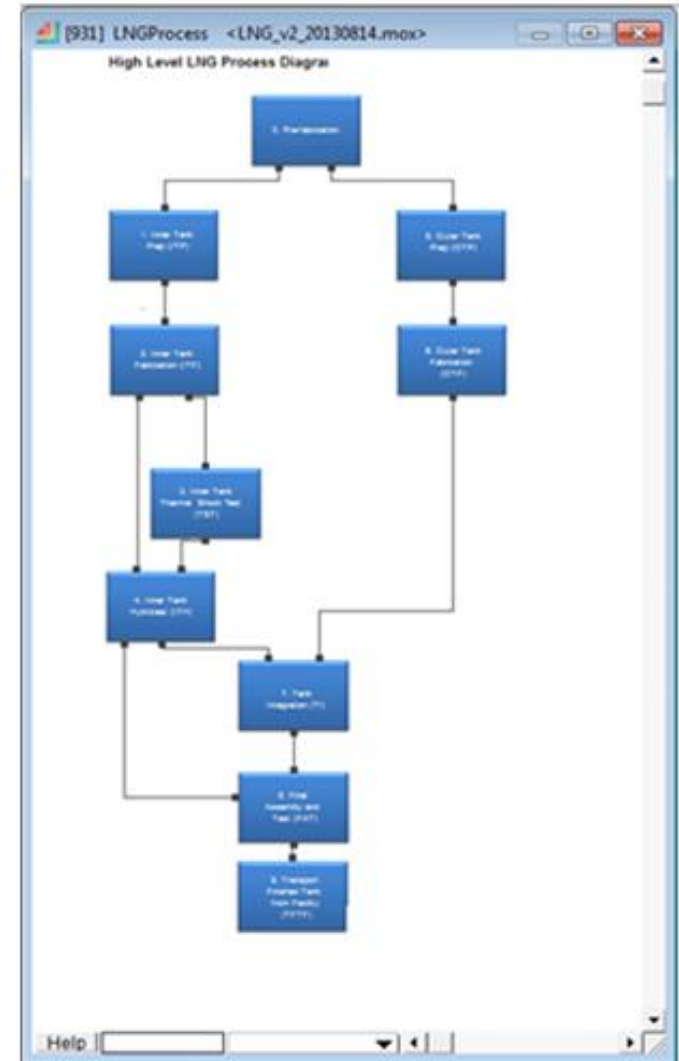
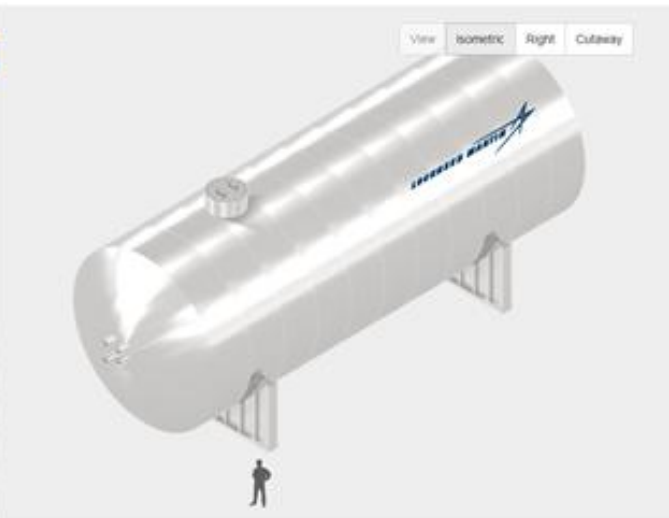
Material

Options

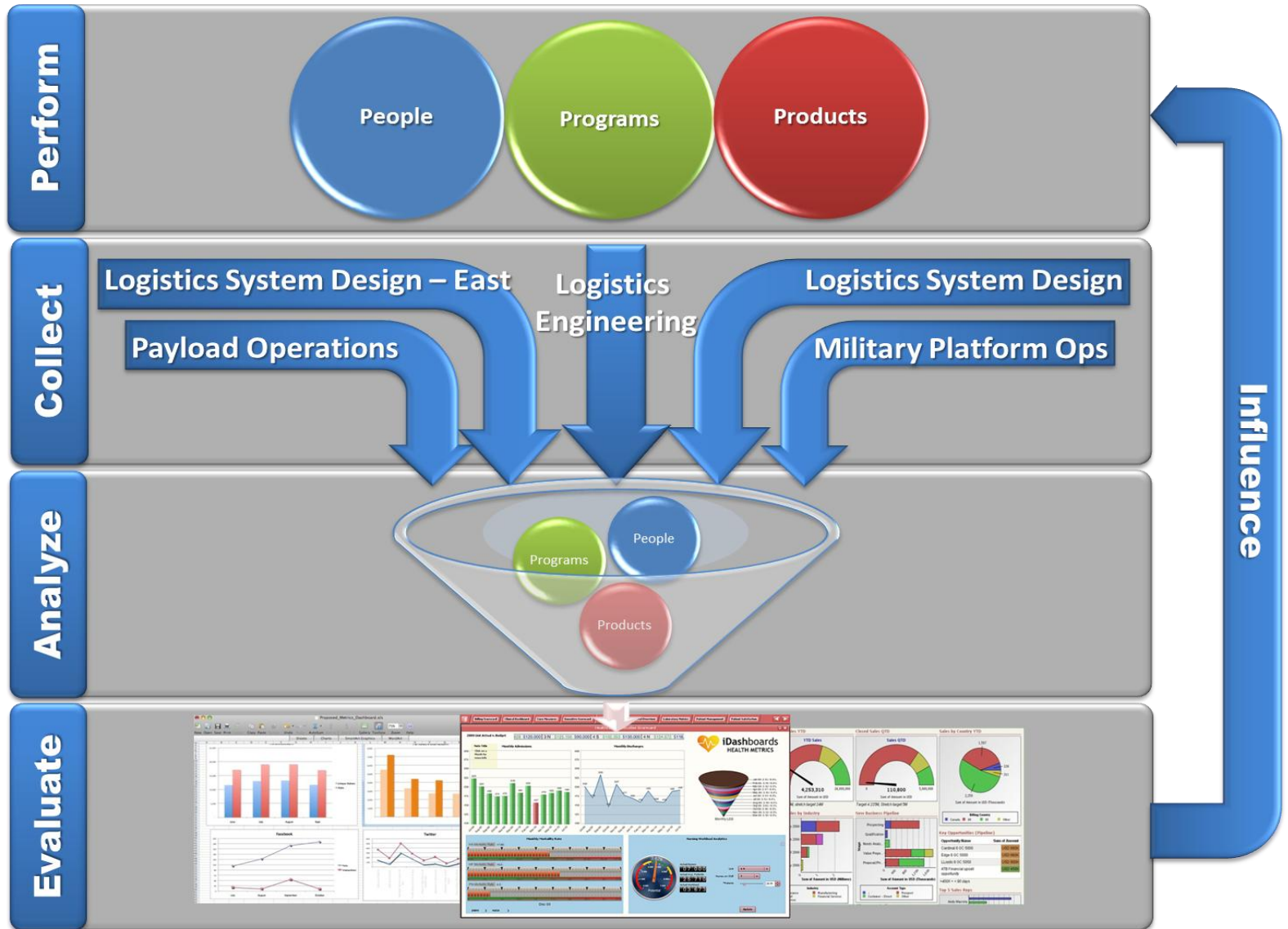
Application

Delivery

Submit Request Type



Affordability Analysis Process Flow



Architecture Performance Analysis Case Study



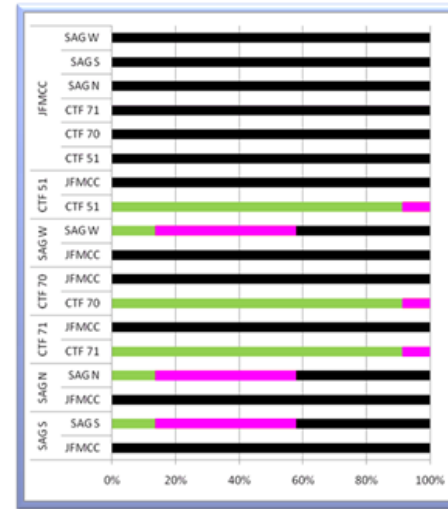
Recent Proposal Past Performance			
Program	% Reduction In Spares	% Reduction In Total Support Costs (Including Warranty)	Total Recommended Cost Savings
Program A	68.0%	48.9%	(>\$10M)
Program B	49.1%	65.1%	(>\$85M)
Program C	58.9%	44.1%	(>\$10M)
Program D	N/A	44.0%	(>\$137M)
Program E	-41.3%	29.8%	(>\$2M)
Program F	58.9%	7.2%	(>\$1.5M)



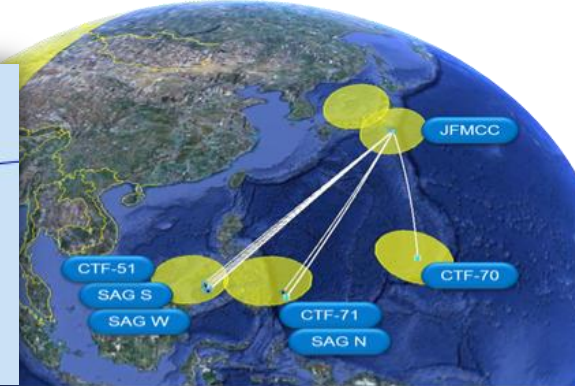
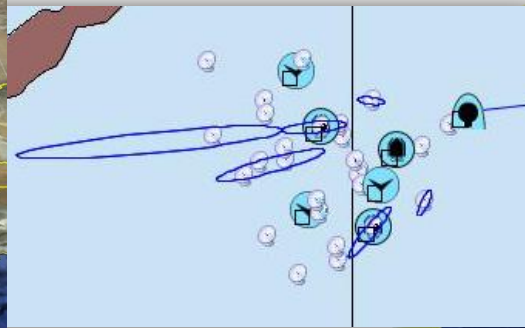
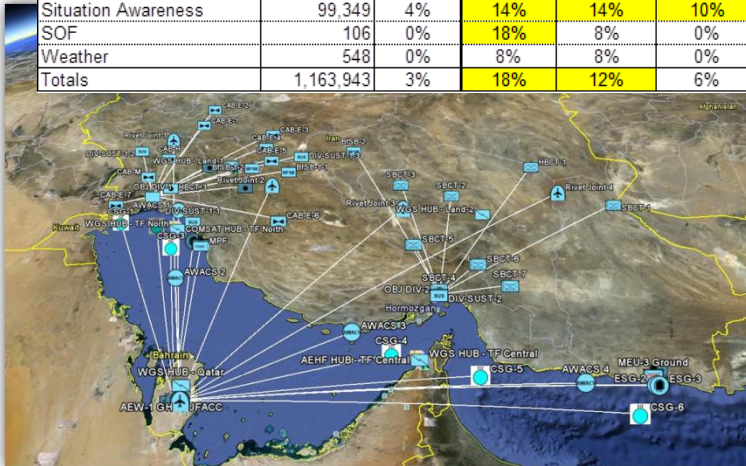
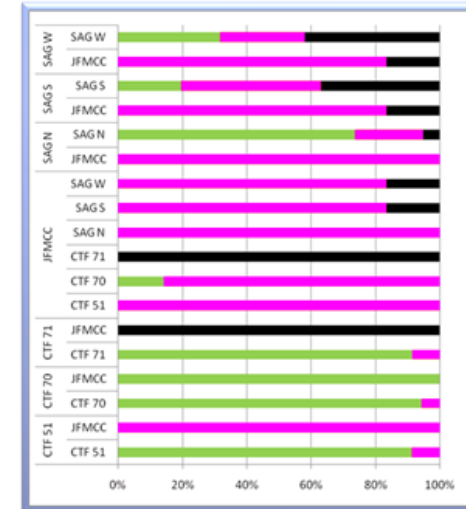
GCM Models Enterprise-Wide Comms

Message Type	Messages	% Terminals Protected				
		Benign	0%	5%	23%	64%
Air Defense/Management	35,464	2%	13%	11%	4%	4%
BDA	6,909	4%	8%	8%	4%	4%
CDR Guidance	14,069	0%	10%	9%	1%	0%
CDR Information Requests	21,325	5%	22%	16%	8%	6%
Civil Affairs	1,970	0%	29%	29%	0%	0%
Collaboration	36,199	2%	13%	12%	5%	3%
Combat Support Systems	48,805	7%	15%	14%	11%	10%
Commander Orders	37,260	4%	16%	13%	7%	6%
Coordination	69,205	2%	10%	9%	5%	4%
COP	247,978	4%	32%	13%	8%	5%
Enemy Reporting	10,817	2%	29%	19%	4%	3%
Fire Support	150,780	2%	14%	13%	6%	2%
FRAGOS	15,331	3%	11%	11%	6%	4%
INTEL	52,370	3%	13%	12%	5%	3%
Medical	4,418	0%	4%	4%	0%	0%
Mission Planning	16,647	0%	1%	1%	0%	0%
NBC	891	2%	12%	9%	7%	2%
Netcentric/Network Data	45,912	1%	33%	23%	1%	1%
OPLANS	8,469	1%	9%	8%	3%	2%
Other	110,448	2%	7%	6%	3%	2%
Sensors	128,673	4%	20%	10%	4%	4%
Situation Awareness	99,349	4%	14%	14%	10%	7%
SOF	106	0%	18%	8%	0%	0%
Weather	548	0%	8%	8%	0%	0%
Totals	1,163,943	3%	18%	12%	6%	4%

No HALE ACNs



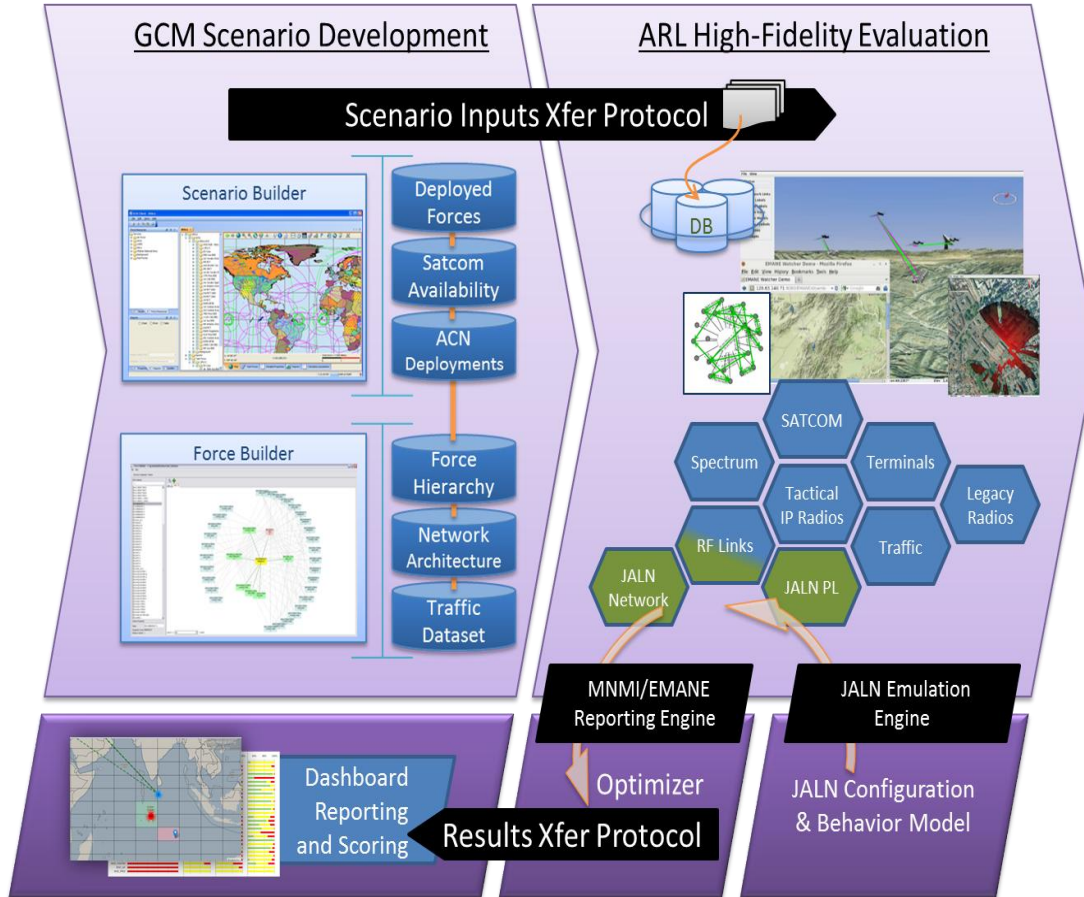
With 3 HALE ACNs in Theater



GCM updating MILSATCOM AoA since 2009: new scenarios, AEHF options, ACNs.



OSD and Army Research Lab: JALN Architecture Research Testbed



- Army Research Lab High-Performance Computing (ARL HPC) cluster runs high-fidelity netcentric communications models
- April '13 OSD and ARL determined that GCM would be the best way to flexibly and rapidly build large, relevant scenarios for their HPC-based communications modeling, including:
 - Unit locations and movements
 - Network topologies
 - Network traffic
- IS&GS working with OSD and ARL to enhance their comm modeling capability for XDR and Link-16 on the path toward a JALN Architecture Research Testbed (JART)



Modeling and Simulation Summary

- ★ Models provide a degree of flexibility to model virtually any customer problem
- ★ Modeling first can save cost, burn down risk, and reduce schedule uncertainty
- ★ Modeling and Simulation can be applied in a multitude a ways to deliver real customer value
- ★ Traditional methods won't address the degrees of variability or system uniqueness
- ★ Models provide customer's and business with rapid "What-if" capability for Long Range Planning