



TRUE PROGRAM SUCCESS '06

PRICE Systems U.S. Symposium
April 19-21
Sheraton San Diego Hotel & Marina
San Diego, CA

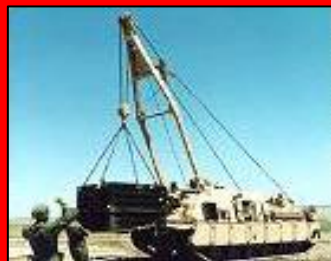
Affordability Program Future Combat System: Manned Ground Vehicles

Roland Enno
BAE Systems - Land & Armaments

PRICE

- ➔ BAE Systems: Land & Armaments
 - Future Combat System (FCS)
 - Armament Systems Division (Minneapolis)
 - Ground Systems Division (Santa Clara, CA and York, PA)
- FCS Affordability
- Managing Affordability
- Responsibilities
- Affordability Process

Land & Armaments - Major Products



Steel Products Division



Advanced Ceramics

Ground Systems Division



International Division



Armament Systems Division



Bofors Defence



Land Systems

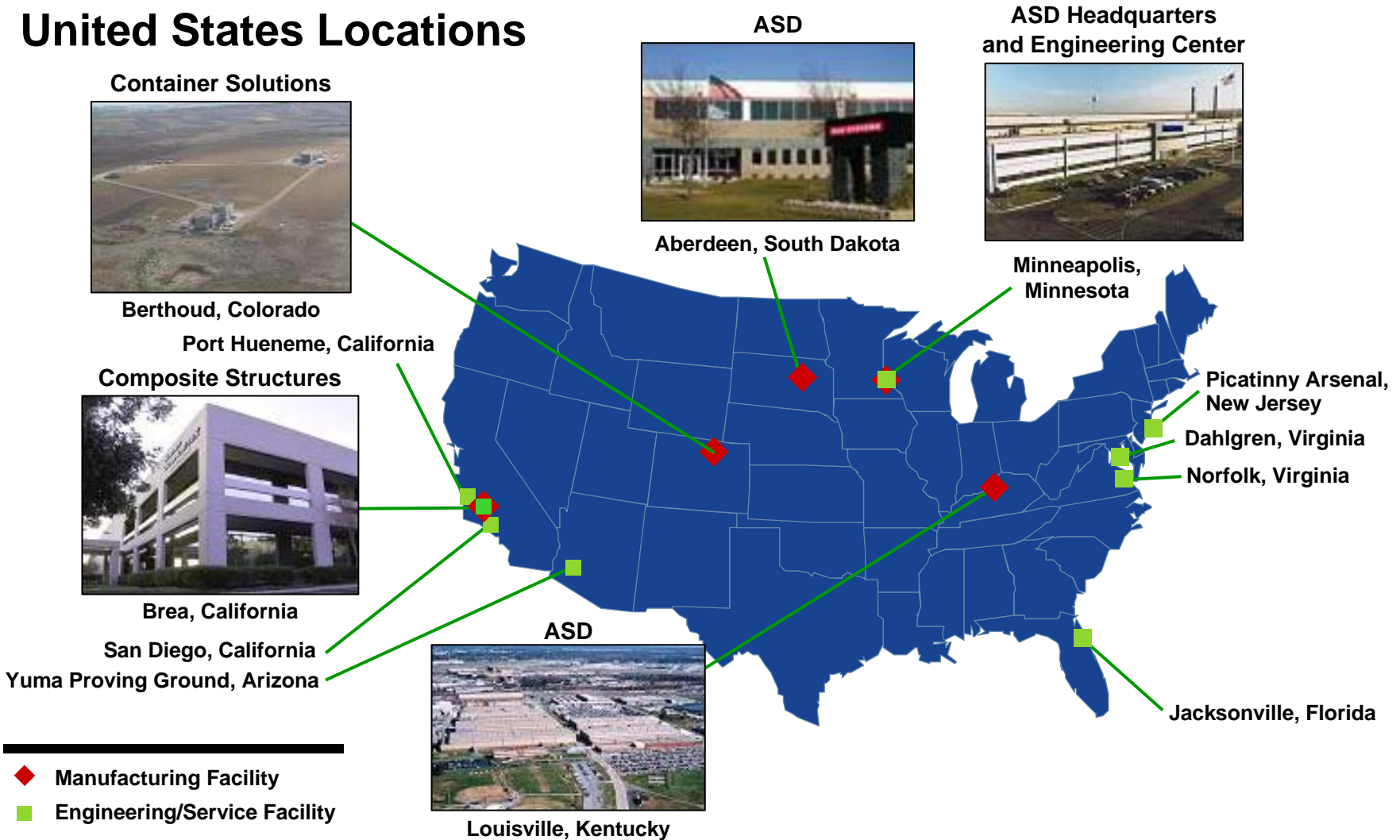


Container Solutions



Composite Structures

United States Locations



United States Locations

Ground Systems Division
and Corporate
Technology Center



Santa Clara, California

Advanced Ceramics



Vista, California

Fayette County,
Pennsylvania

Ground Systems
Division Headquarters



York, Pennsylvania

Triangle, Virginia

Ground Systems Division



Aiken, South Carolina

Albany, Georgia

Orlando, Florida

- ◆ Manufacturing Facility
- Engineering/Service Facility

Future Combat System

An Integrated Family of Highly Capable Core Systems (Nodes)

FUTURE COMBAT SYSTEMS
FCS
One Team - The Army/Defense/Industry

Manned Systems

Infantry Combat Vehicle

Command & Control Vehicle

Mounted Combat System

Reconnaissance and Surveillance

Non-Line-Of-Sight Mortar

Non-Line-Of-Sight Cannon

Soldier Systems

Unmanned Air Platforms

Class I & II Class III Class IV

Unmanned Ground Vehicles

Small Manpackable UGV

Armed Robotic Vehicle **MULE**

- Unmanned Payloads
- Unattended Ground Sensors
- Unattended Munitions
 - NLOS-LS
 - Intelligent Munitions

Maintenance and Recovery **Medical Treatment and Evacuation**

"Approved for Public Release, Distribution Unlimited, TACOM 26 Aug 2004, FCS Case 04-076"

View of the Manned Ground Vehicle (MGV) IPT

MGV



Organizational View

- Army, LSI, BAE Systems/GDLS membership on all Integrated Product Teams (IPTs)
- Close liaison to all product IPTs external to MGV
 - C4ISR
 - Training
 - Supportability
 - UGV/UAV

Architectural View

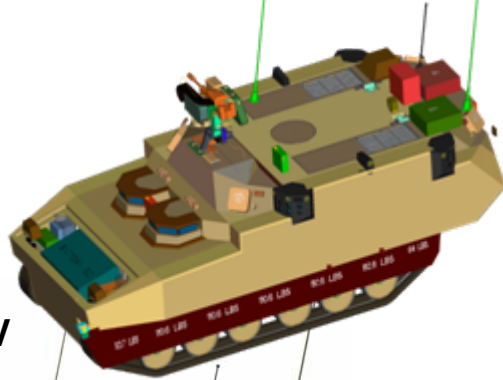
- All variants consist of Mission Module on Common Chassis
- Commonality at all levels...
 - FCS Common (e.g. computers)
 - MGV Common (e.g. engine)
 - Common parts (e.g. drives)

All Variants built on Commonality

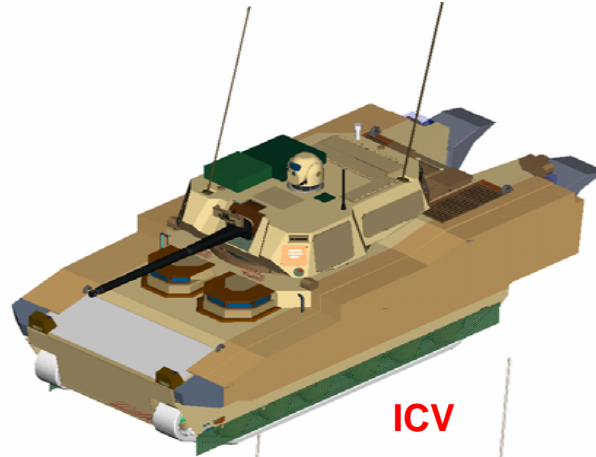
FCS Manned Ground Vehicle (MGV) Program

BAE SYSTEMS

C2V



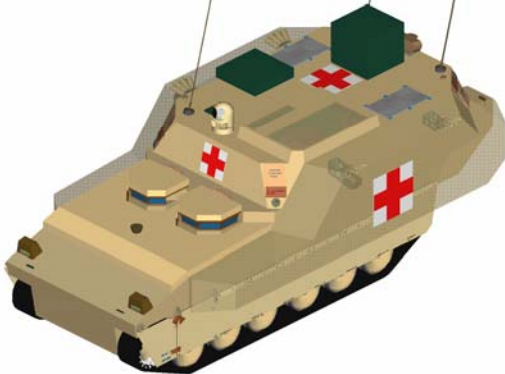
ICV



FRMV



MV-E / MV-T



RSV



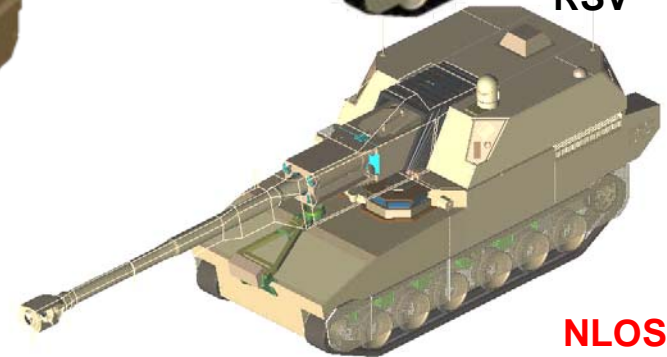
MCS



NLOS-M



NLOS-C



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- TOC includes costs incurred during the total life of a program, system, or aggregation of systems
 - Research & Development
 - Production
 - Military Construction
 - Deployment (Military Personnel)
 - Operating & Support
 - Disposal

- Must be Visible
 - Incentives:
 - Award Fee
 - Cost Reduction Improvement (CRI) Program
 - Major Topic in Program Reviews
- Obtain Management Support
 - Customer (Including User)
 - Contractor
 - Subcontractor

Integrate TOC into Management Philosophy (con't)

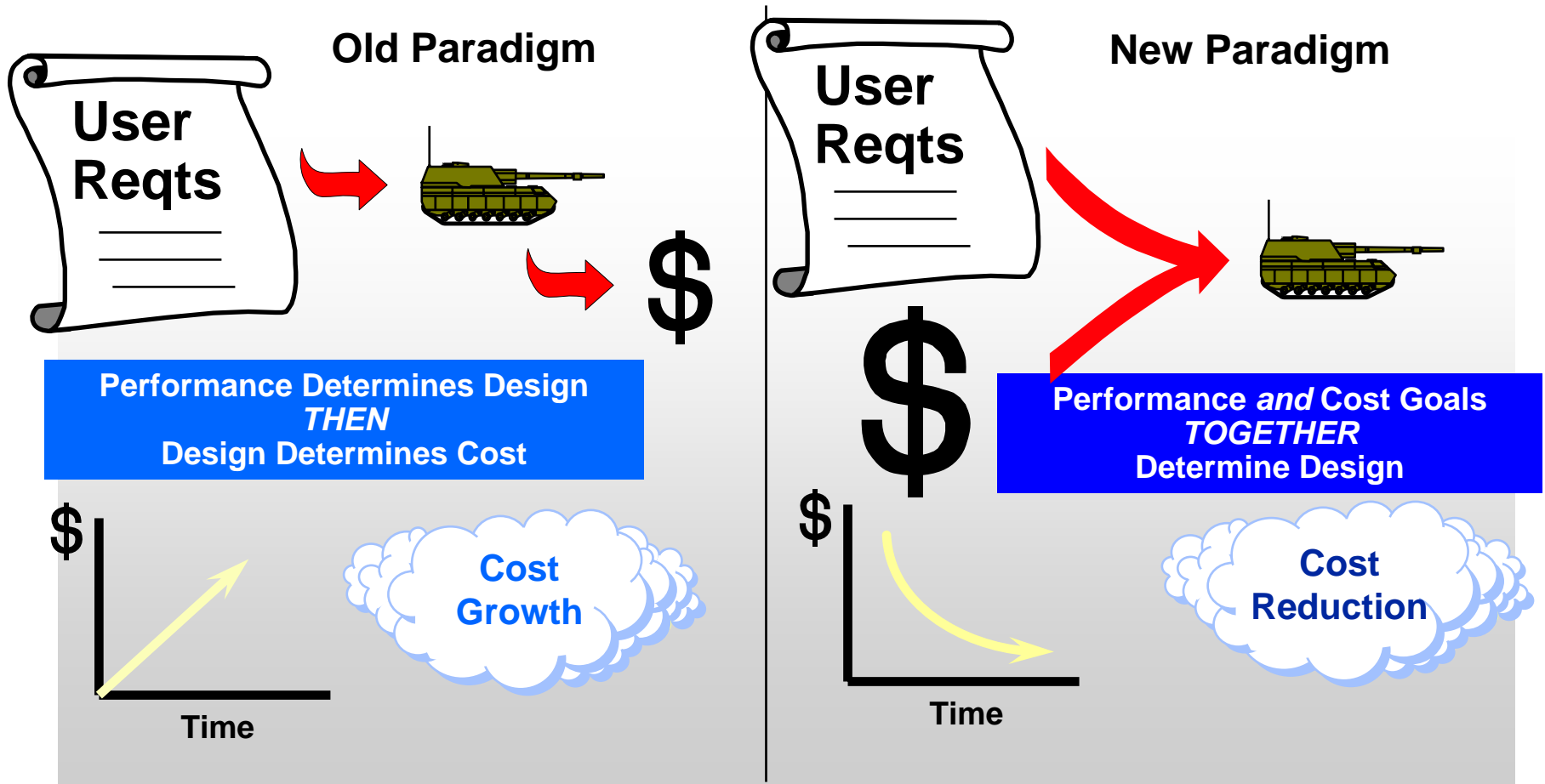
- FCS Cost IPT
- Discipline Embedded in Design Culture
 - Active Participant in Day to Day Activities
 - Participates in Major Design Review
 - Makes Cost a Key Variable for Every Trade Study
- Training
 - Customer
 - Company Personnel
 - Subcontractor Personnel

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- Develop and Maintain a CAIV/DTC Plan
 - Outlines Organizational Responsibilities
 - Identification of Essential Requirements as Tradable and Not Tradable
 - Definition and allocation of cost targets to product teams
 - Identification and implementation of cost improvement initiatives
 - Support to trade studies and identification of cost drivers
 - Preparation of Affordability Reports and Status
 - Implementation and coordination of the CAIV Process within each of the Elements to ensure the Life Cycle Cost Containment Strategy is properly executed with in the Program
 - Support to Affordability Status Reviews

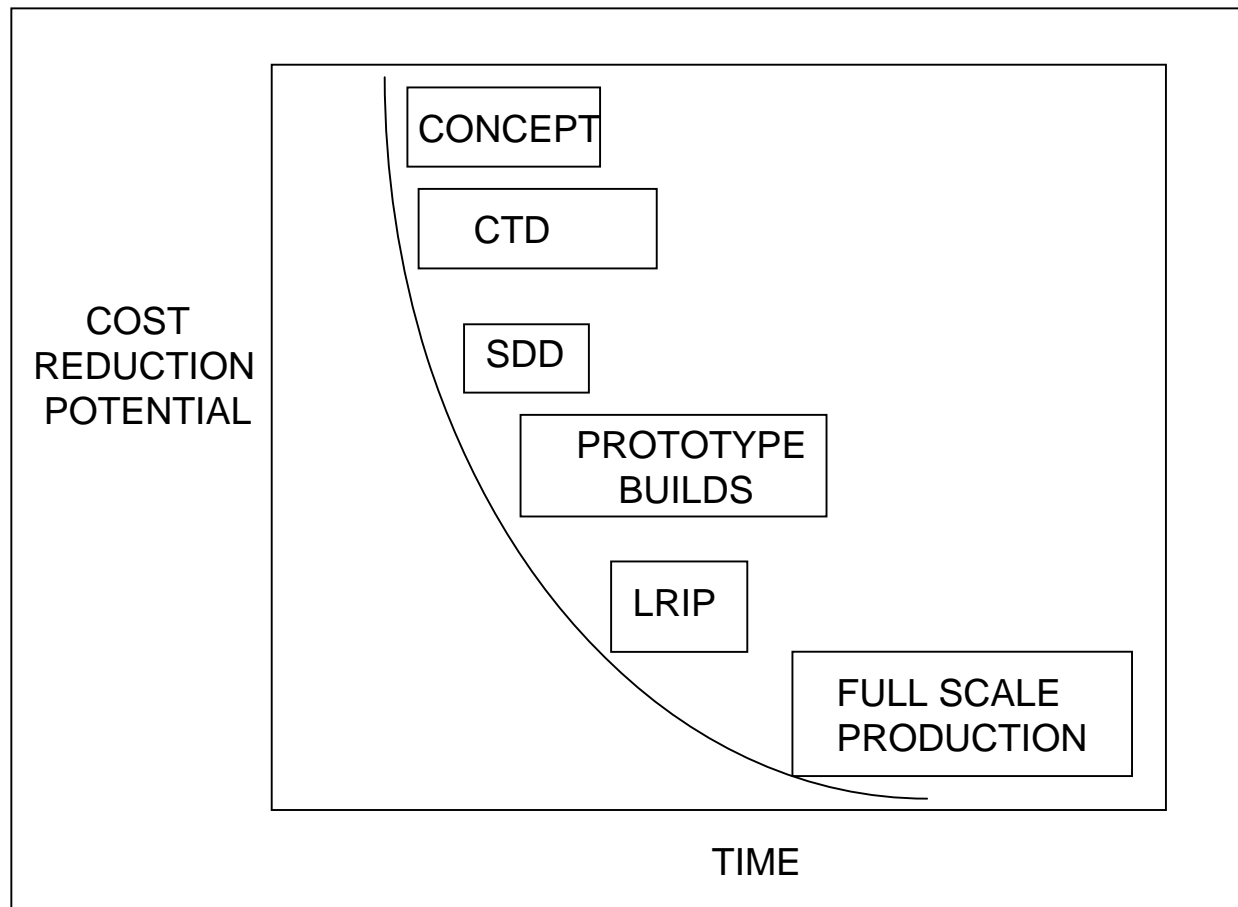
- Establish and Maintain a CAIV/DTC Data Base
 - Track Changes to AUPC Estimate
 - Generate Required Internal/External Reports
- Implement Design Trade Studies
- Develop a Cost Reduction Initiative (CRI) Process
- Develop Metrics
 - AUPC at Brigade Combat Team (BCT)
 - AUPC at Variant (Vehicle)
- Develop Corrective Action Plans if Required

Affordability Overview (con't)



CAIV is Effective Cost Management

Cost Reduction Window of Opportunity



- FCS SOW
 - Implement the FCS Life Cycle Cost (LCC) Containment Strategy as defined Life Cycle Cost Containment Plan by Boeing
 - Incorporate the principles of Cost As an Independent Variable (CAIV) to balance cost, performance, and schedule

- FCS SOW

- Develop Affordability Implementation Plan (AIP) and define the strategy, processes and procedures “for performing ongoing affordability assessments to ensure the satisfaction of the LSI requirements within program target cost”
 - Development of affordable cost and price objectives
 - Identification of essential requirements as tradable and not tradable
 - Definition and allocation of cost targets to product teams
 - Identification and implementation of cost improvement initiatives
 - Support to trade studies and identification of cost drivers
 - Revising and publishing inputs to the Cost Analysis Requirements Descriptions (CARs) on a semi-annual basis
 - Preparation of Affordability Reports and Status
 - Implementation and coordination of the Cost As an Independent Variable (CAIV) Process within each of the elements to ensure the Life Cycle Cost Containment Strategy (D786-10012-1) is properly executed within the Program
 - Support to affordability status reviews as required

- Achieve the Milestone C AUPC target
- Minimize Life cycle cost (LCC)
- Meet the current program cost and schedule goals
- Deliver the best performance and quality to ensure customer satisfaction

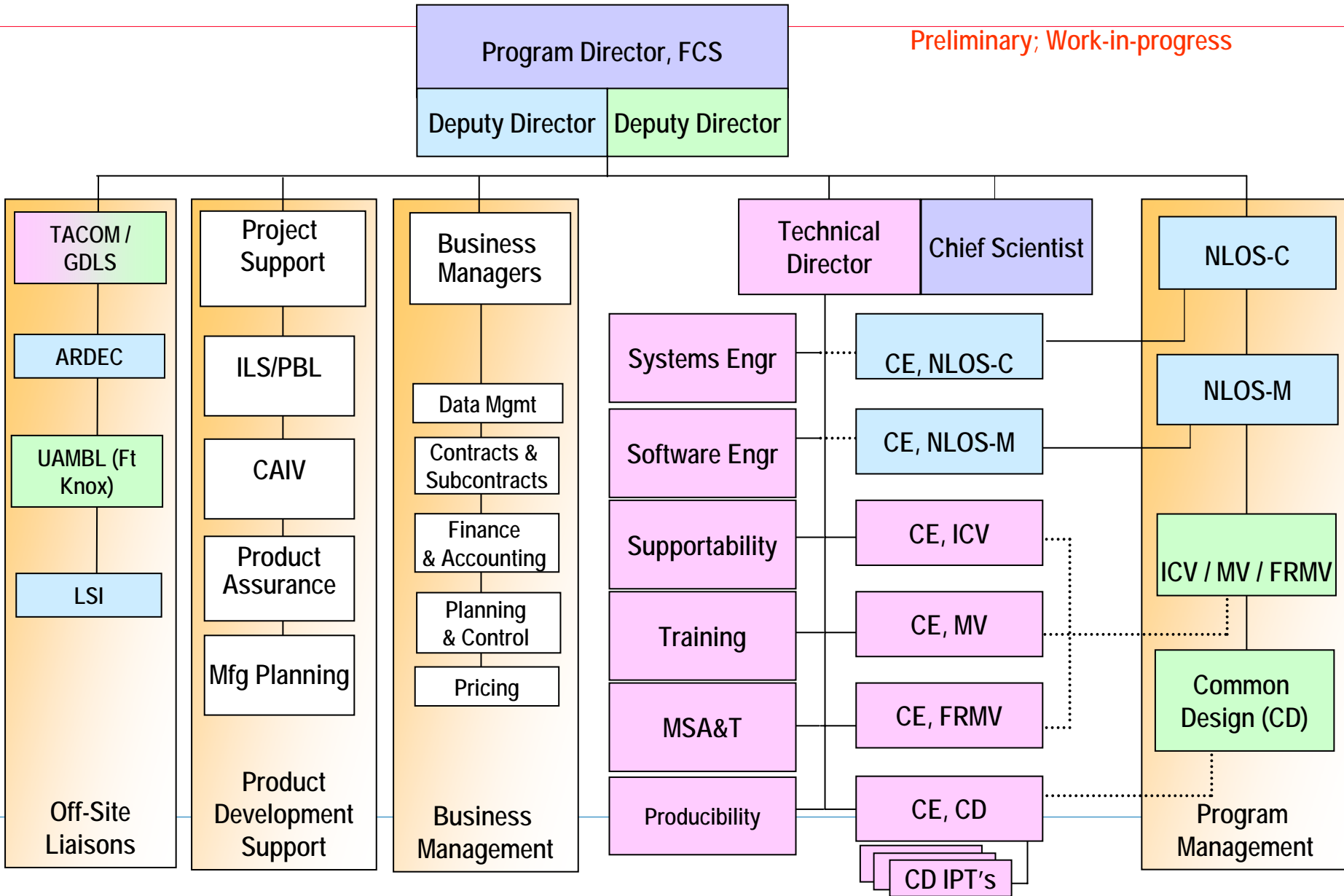
Affordability Management Approach and Strategy

- Implement CAIV principles and practice throughout the development process and program execution
 - Ensure cost is considered equal in importance to technical performance throughout the development process and is treated as an independent design variable

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MGV Organization

Preliminary; Work-in-progress



- CAIV / DTC / Affordability
- IPT's
- Program Management
- CAIV / DTC Management
- Subcontractors

- Owner of the program affordability process, responsible for its implementation and execution
- Specific tasks include
 - Affordability Implementation Plan
 - CAIV process management and execution
 - Allocation and tracking of cost targets
 - LCC estimating
 - Assisting trade studies
 - Managing the Cost Reduction Initiatives
 - Interface with LSI's *C4ISR Affordability IPT*, including the Affordability Initiatives
 - Reporting

- Common Equipment and Variant IPT's
 - Accountable for carrying out the affordability process at system and subsystem levels
 - Meeting subsystem cost targets (interim and program milestone C)
 - Identification and implementation of Cost Reduction Initiatives
 - Conducting CAIV trade studies
 - Identification and implementation of Cost Reduction Initiatives
 - Supporting CAIV trade studies

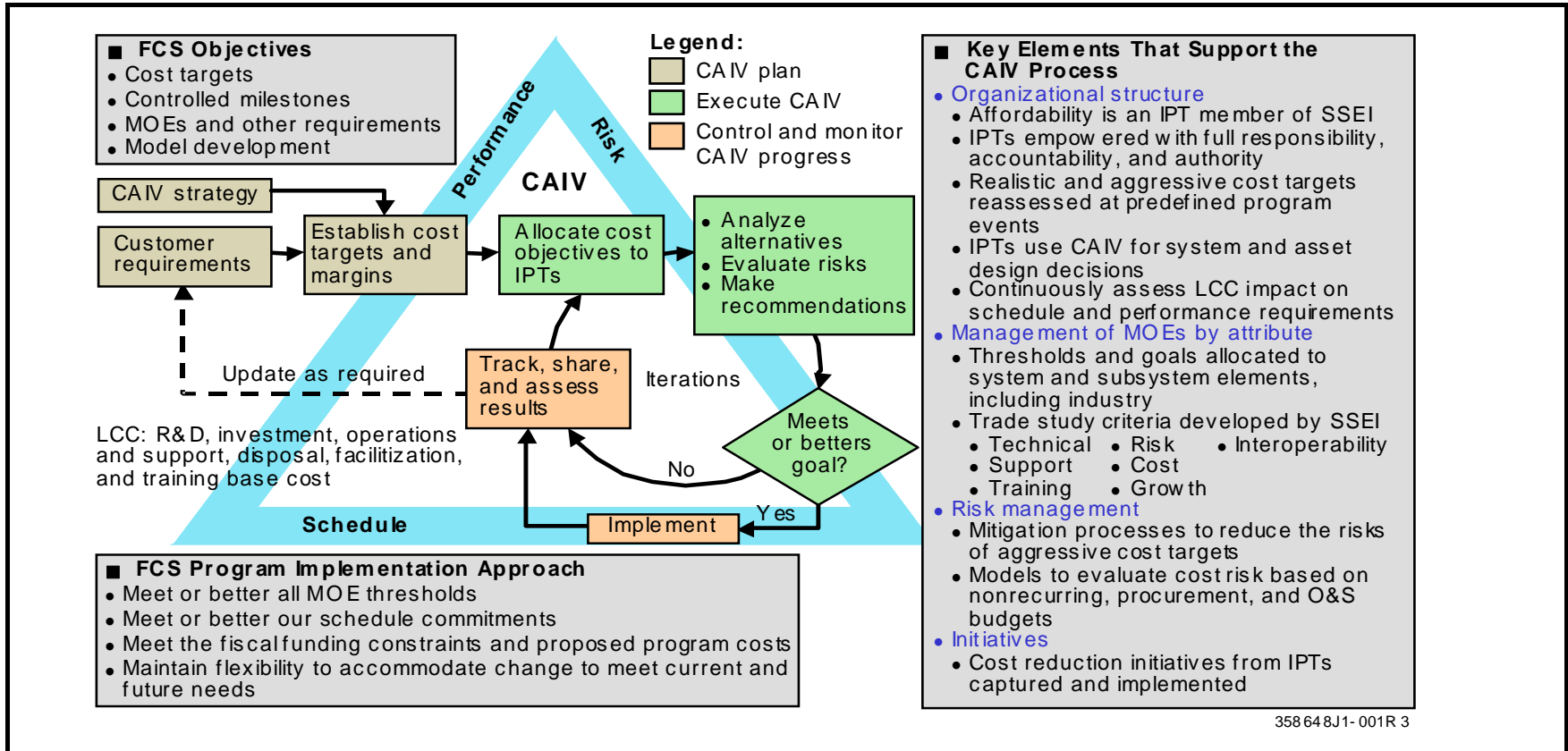
- *Program Director and Deputy Program Directors*
 - Assume overall affordability/CAIV responsibility and authority
 - Manage and exercise ownership over Army and LSI assigned Milestone C and Interim AUPC targets and commit to targets.
 - Review targets, allocate targets to lower-level subsystems and installations, and assign responsibility
 - Enforce the CAIV procedures
 - Oversee and evaluate subcontractor and supplier CAIV operations
 - Compile Monthly Progress Reports and as required corrective action plans

- *CAIV / DTC Affordability Manager*
 - Manages the CAIV program
 - Prepares and executes the Affordability Implementation Plan
 - Supervises CAIV/DTC engineers and assignments
 - Responsible for cost estimating and cost models
 - Oversees current estimating activity as design changes
 - Maintains an accurate audit trail of the current estimates, cost glide path, CRIs, and the cost portion of the systems database
 - Interfaces with IPT's and maintains subsystem-level cost targets
 - Reviews trade study estimates and outcomes
 - Oversees and Approves LCC Estimate Quarterly Reports
 - Interfaces with LSI's affordability IPT and OTP Leads

- *CAIV/DTC Engineer*
 - Integrated into Variant and Common IPT's
 - Integrated into Design Teams and Systems functions
 - Supports system-level trade studies
 - Develops current cost estimates
 - Maintains Targets and Component Targets
 - Prepares LCC Containment Estimates for Quarterly Reports
 - Monitors and evaluates IPT's and suppliers' CAIV management
 - Develops Corrective Action Plans for Team When Necessary

- Affordability requirements flow down
 - Reporting Requirement
 - Subcontractor CAIV Plan
 - Subcontractor CAIV Status Report
 - Corrective Action Plan
 - Participation in Cost Reduction Initiative

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CES	Title	Development	Production	URC**	AUPC	LCC/TOC***
1.00	RDTE	X				X
2.00	Procurement-Funded Elements					X
2.01	Nonrecurring Production		X*	X		
2.02	Recurring Production		X*	X	X	
2.03	Engineering Changes		X*	X		
2.04	System Engineering/Program Management		X	X		
2.05	System Test & Evaluation (Production)		X	X		
2.06	Training		X			
2.07	Data		X			
2.08	Support Equipment		X			
2.09	Operational/Site Activation		X			
2.10	Fielding		X	X***		
2.11	Training Ammunition/Missiles		X			
2.12	War Reserve Ammunition/Missiles		X			
2.13	Modifications		X			
2.14	Other Procurement		X			
3.00	Military Construction					X
4.00	Military Personnel					X
5.00	Operations & maintenance					X

* These Items Comprise the Prime Mission Equipment WBS element.

** Includes C4ISR and Buyer Furnished Equipment (BFE)

*** Includes First Destination Transportation Cost Only

**** TOC includes all elements of LCC plus the total infrastructure cost to plan, manage and execute the weapon system over its full life.

- Develop Cost Estimates Based on “Like” Equipment
- Compare Components with Customer
- Compare Cost Estimates with Customer
- Identify Major Cost Drivers
- Identify Primary Requirements Driving Cost
- Develop Glide Path

Tool	Description
PRICE H, HL	Part of PRICE Systems family of parametric cost estimating models. PRICE H estimates hardware costs, resources, and schedules for hardware development and acquisition, including electronic, electro-mechanical, and structural assemblies. PRICE HL, commonly used with PRICE H, estimates hardware life-cycle costs, including development, production, and support.
FCS Spreadsheet	Excel Spreadsheet used to integrate estimated subsystem and component costs, supplier price quotes, and organized the cost estimate according to the CES defined in the Army Cost Analysis Manual.
Access Database	Internal database for storing and tracking affordability and CAIV process data, including estimating reports, cost targets, glide path, cost reduction initiatives, and trade study documents.
ACE	Web-based portal for sharing and collaboration of program information, technical and engineering data, and reports, by the geographically distributed program team.

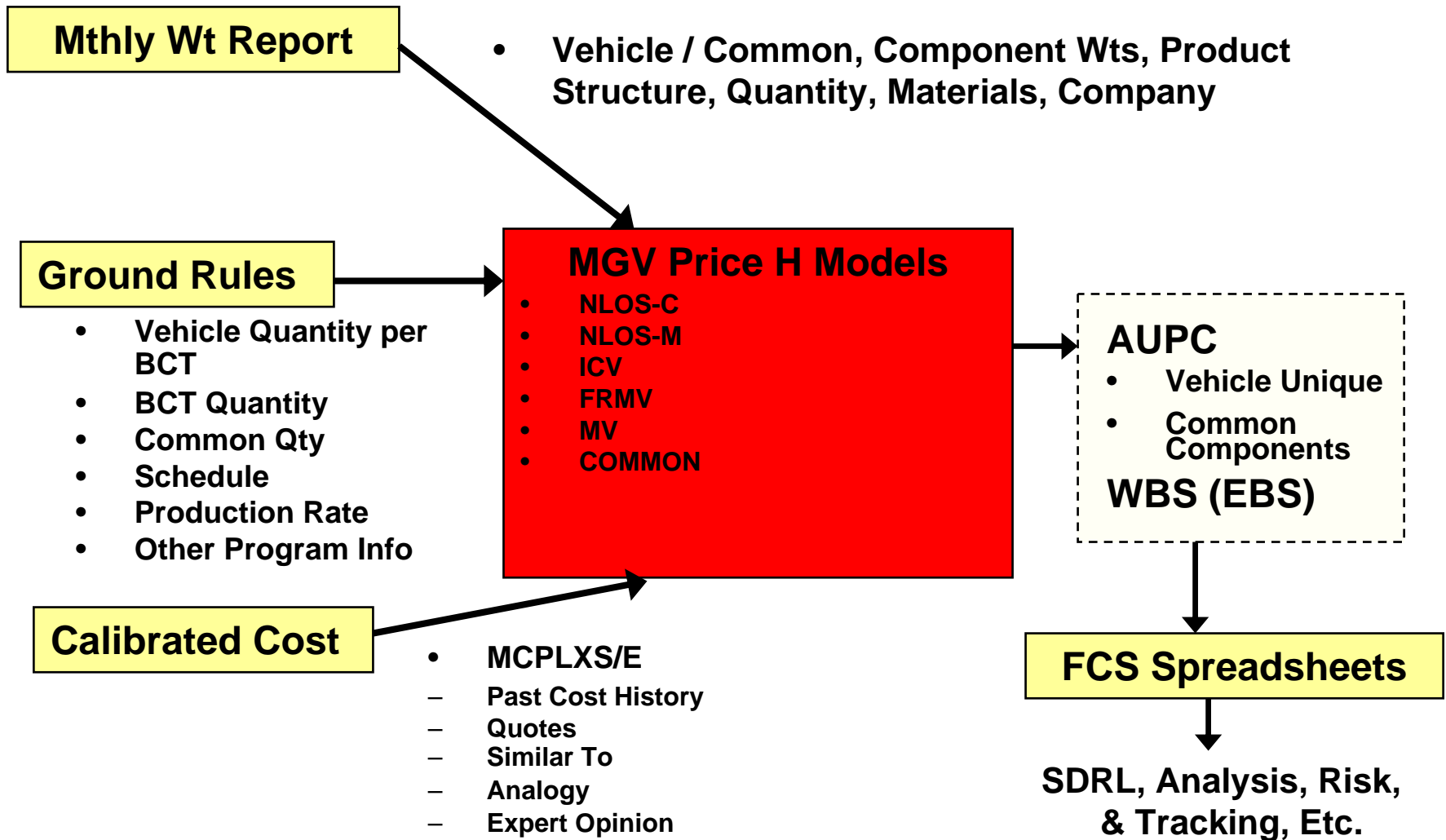
Brigade Combat Team (BCT)

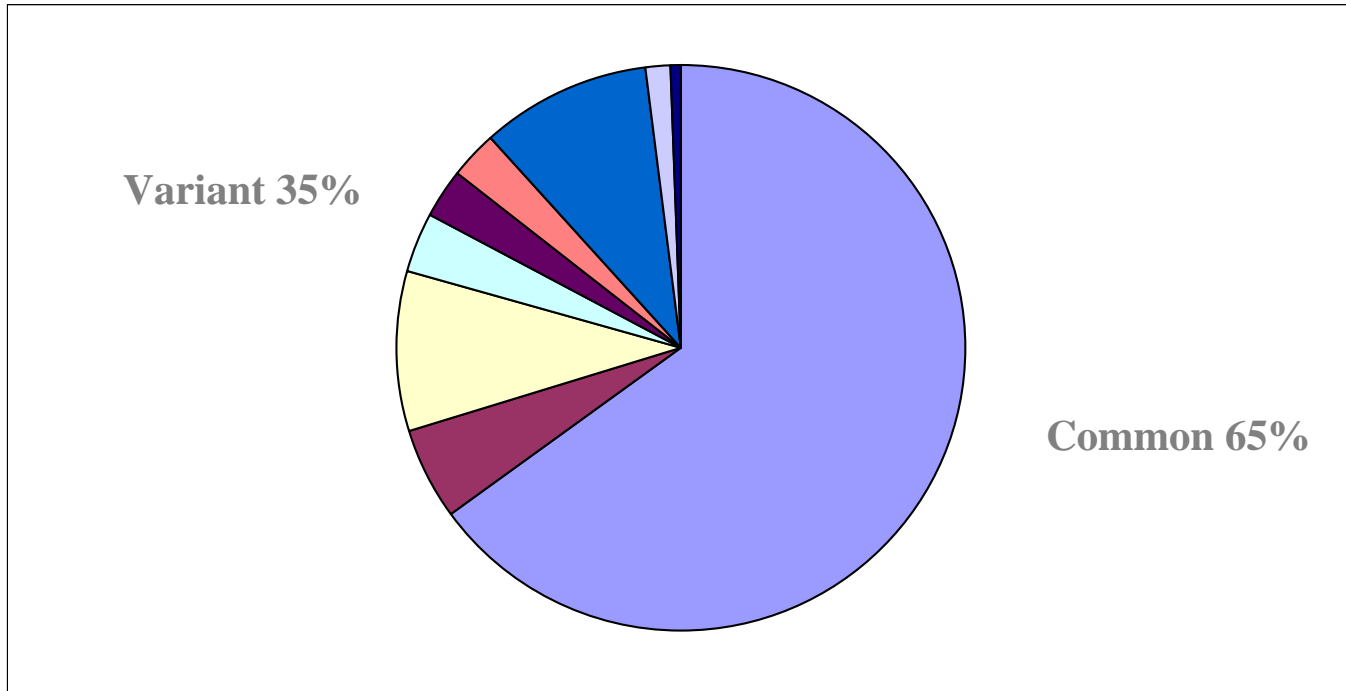
BCT QTY PER YR		
Platform	Total Per BCT	Total 15 BCT
MCS	62	930
ICV	105	1,575
NLOS-M	25	375
NLOS-C	19	285
C2V	50	750
RSV	31	465
MV-T	10	150
MV-E	20	300
FRMV	11	165

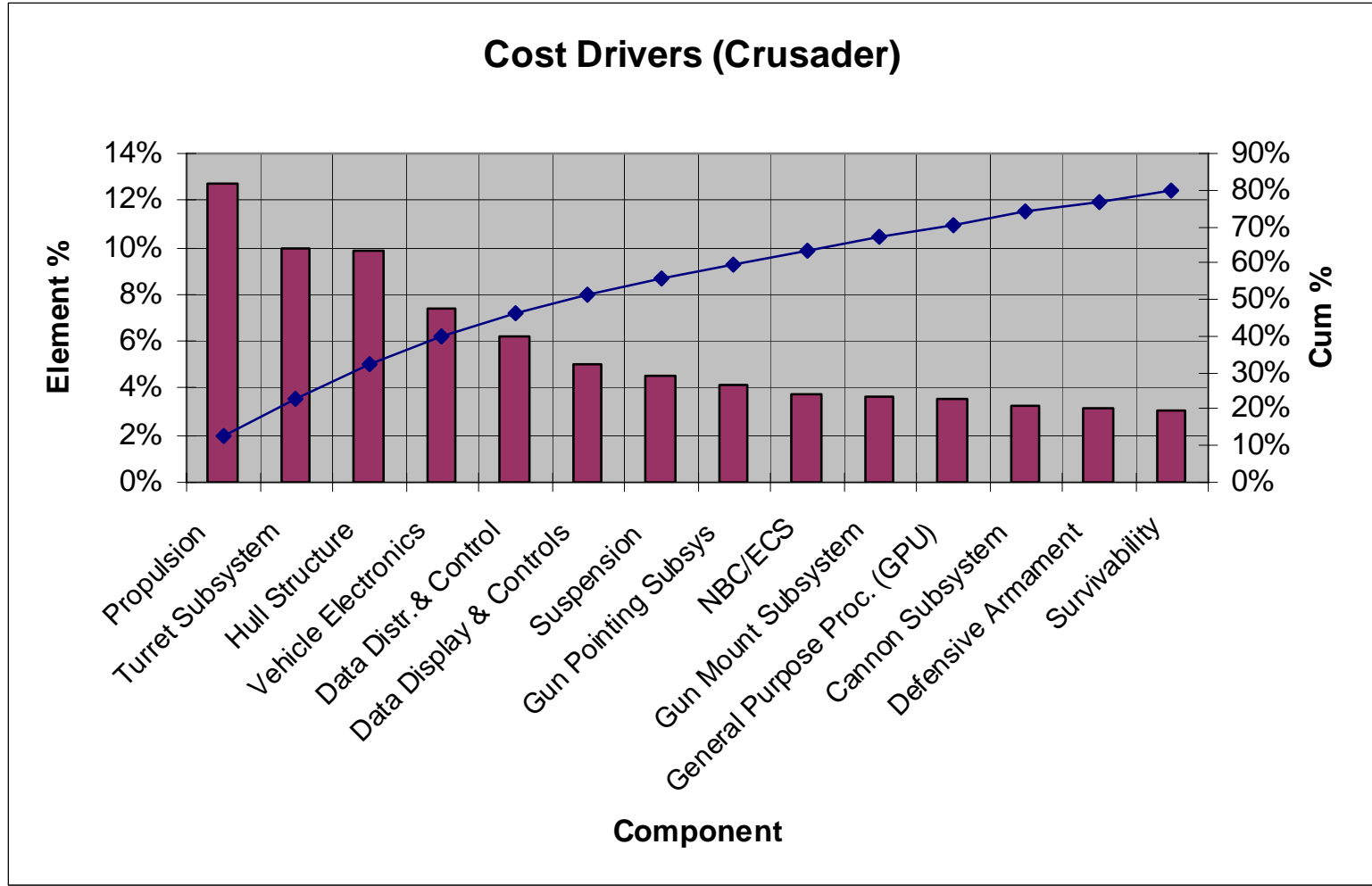
Weight Report

Variant	NLOS-M				
ECC/FCC	(All)				
Status	Current				
			Total Weight in KG		
Total Weight			Common/Variant		
Subsystem	Installation		Common	Variant	Grand Total
AFES					
	AFES, Crew Compartment Installation		10.00		10.00
	AFES, Engine Compartment Installation		10.00		10.00
	AFES, High Voltage Battery Compartment Installation		10.00		10.00
	AFES, Mission Area Installation			10.00	10.00
	AFES, Turret Installation			10.00	10.00
AFES Total			30.00	20.00	50.00
ALLOWANCES					
	Shoring		0.00		0.00
ALLOWANCES Total			0.00		0.00
ANS					
	ANS, Chassis Installation		10.00		10.00
ANS Total			10.00		10.00
ARMOR					
	Armor, Belly, Chassis Installation		10.00		10.00
	Armor, Front Skirt Installation		10.00		10.00
	Armor, Integral, Chassis Installation		10.00		10.00
	Armor, Modular, Chassis Installation		10.00		10.00
	Armor, Modular, Mission Area Installation			10.00	10.00
	Armor, Modular, Turret Installation			10.00	10.00
	Armor, Rear Skirt Installation		10.00	10.00	20.00
	Spall Liner, Chassis Installation		10.00		10.00
	Spall Liner, Mission Area Installation		10.00		10.00
ARMOR Total			70.00	30.00	100.00

PRICE H: Primary Estimating Tool



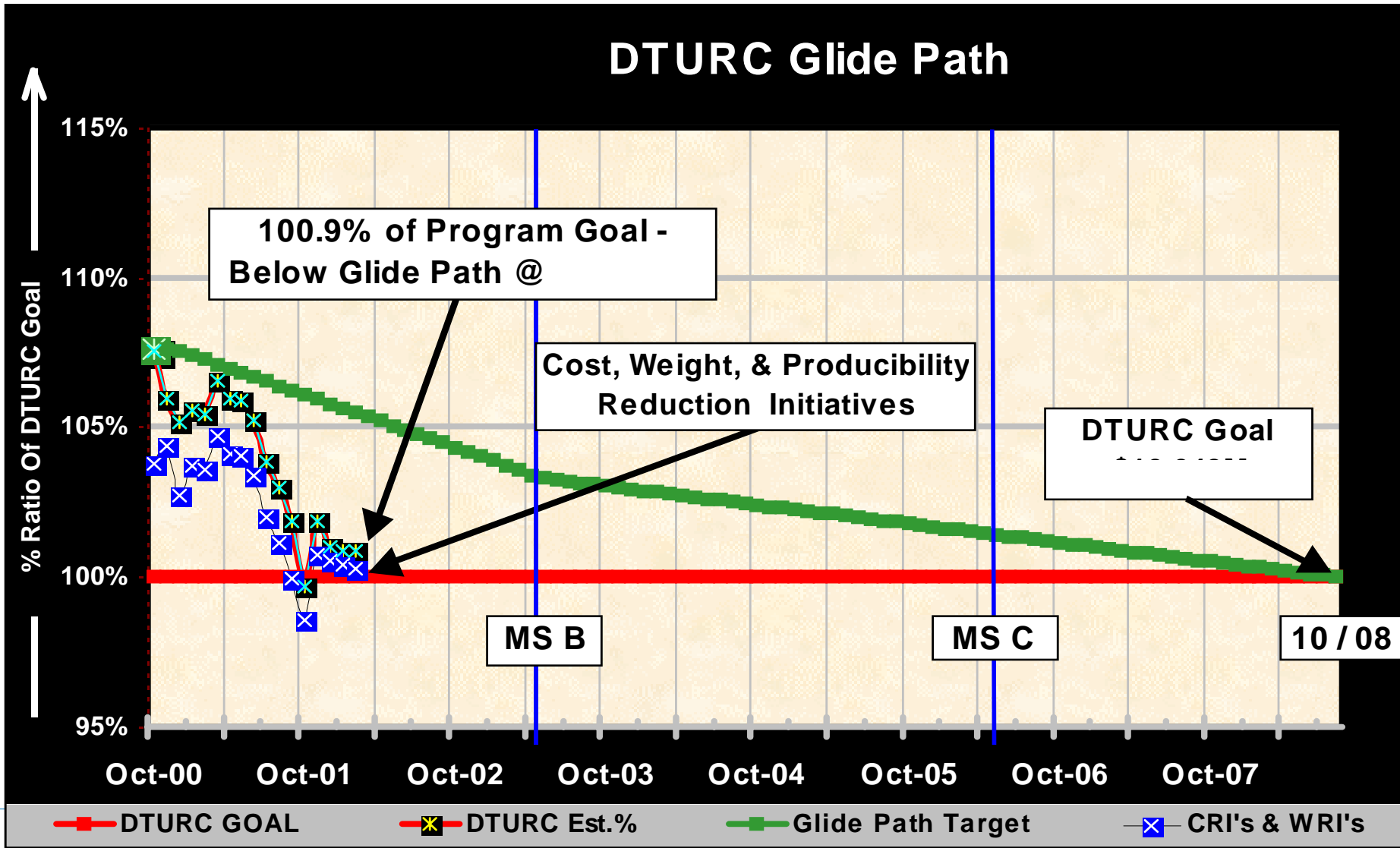




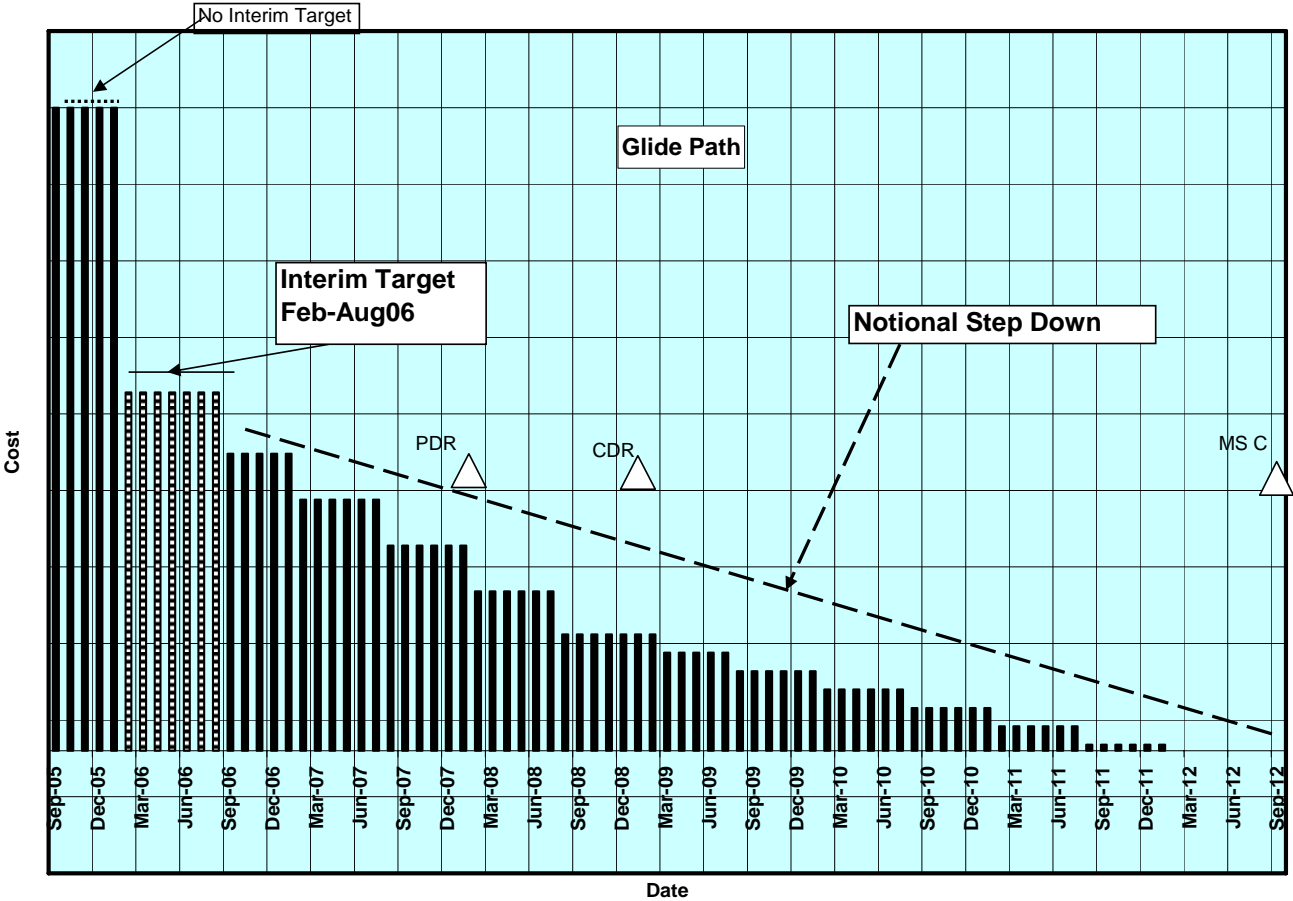
AUPC Validation by Subsystems

	Ownership	% Actuals	% COTS	% Vendor Quote	% Actual Cost for Similar to Hardware	% Detailed Build-Up	% Model Generated	% Price Book Value	% Engineering Estimate
		0.0%	0.0%	20.8%	13.8%	19.6%	3.4%	0.0%	42.3%
COMMON		0.0%	0.0%	15.1%	1.7%	33.8%	0.1%	0.0%	49.3%
Subsystem 1		0.0%	0.0%	0.0%	93.0%	0.0%	0.0%	0.0%	7.0%
Subsystem 2		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Subsystem 3		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Subsystem 4		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Subsystem 5		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Subsystem 6		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Subsystem 7		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Subsystem 8		0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%
Subsystem 9		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Subsystem 10		0.0%	0.0%	25.1%	0.0%	51.7%	0.9%	0.0%	22.3%
Subsystem 11		0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%
Subsystem 12		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Subsystem 13		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Subsystem 14		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Subsystem 15		0.0%	0.0%	0.0%	2.2%	0.0%	0.0%	0.0%	97.8%
Subsystem 16		0.0%	0.0%	0.0%	15.0%	0.0%	0.0%	0.0%	85.0%
Subsystem N		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Example: DTURC Goal & Glide Path

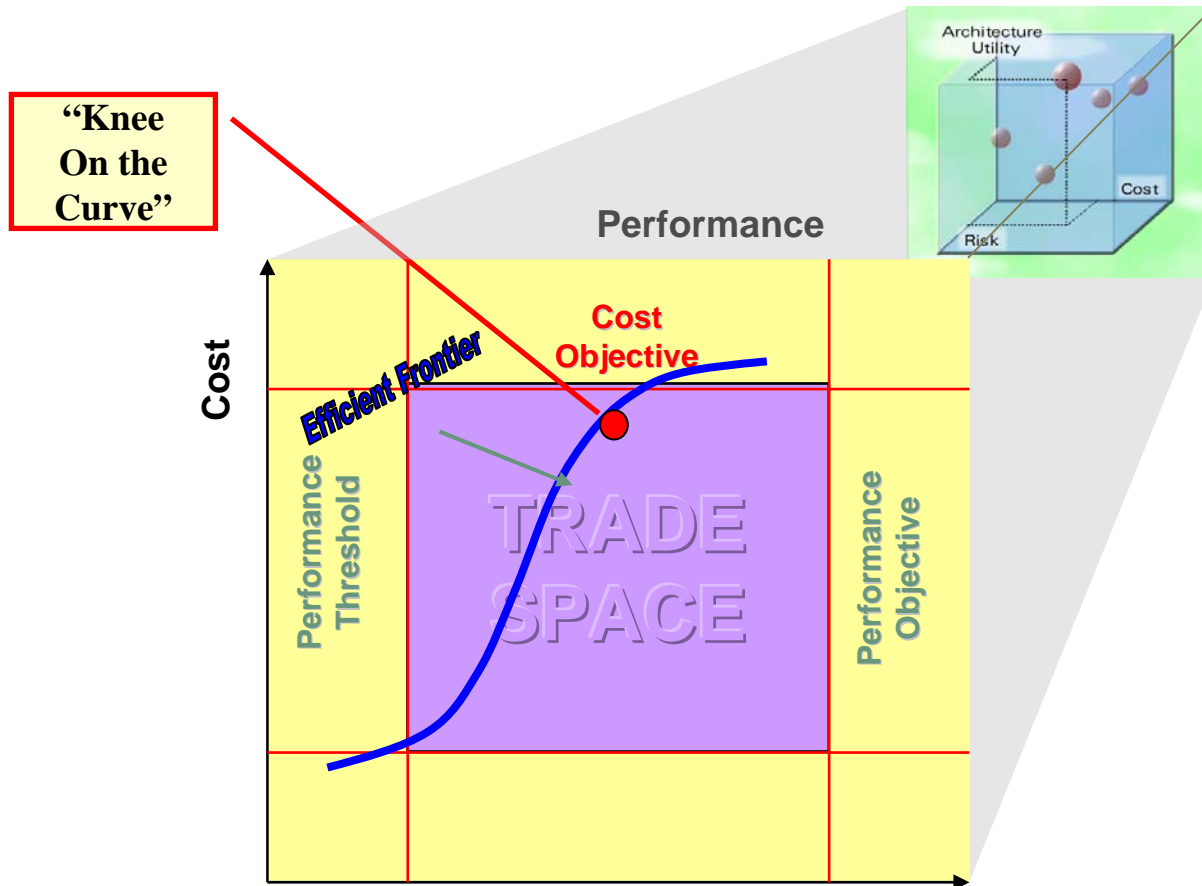


Glide Path

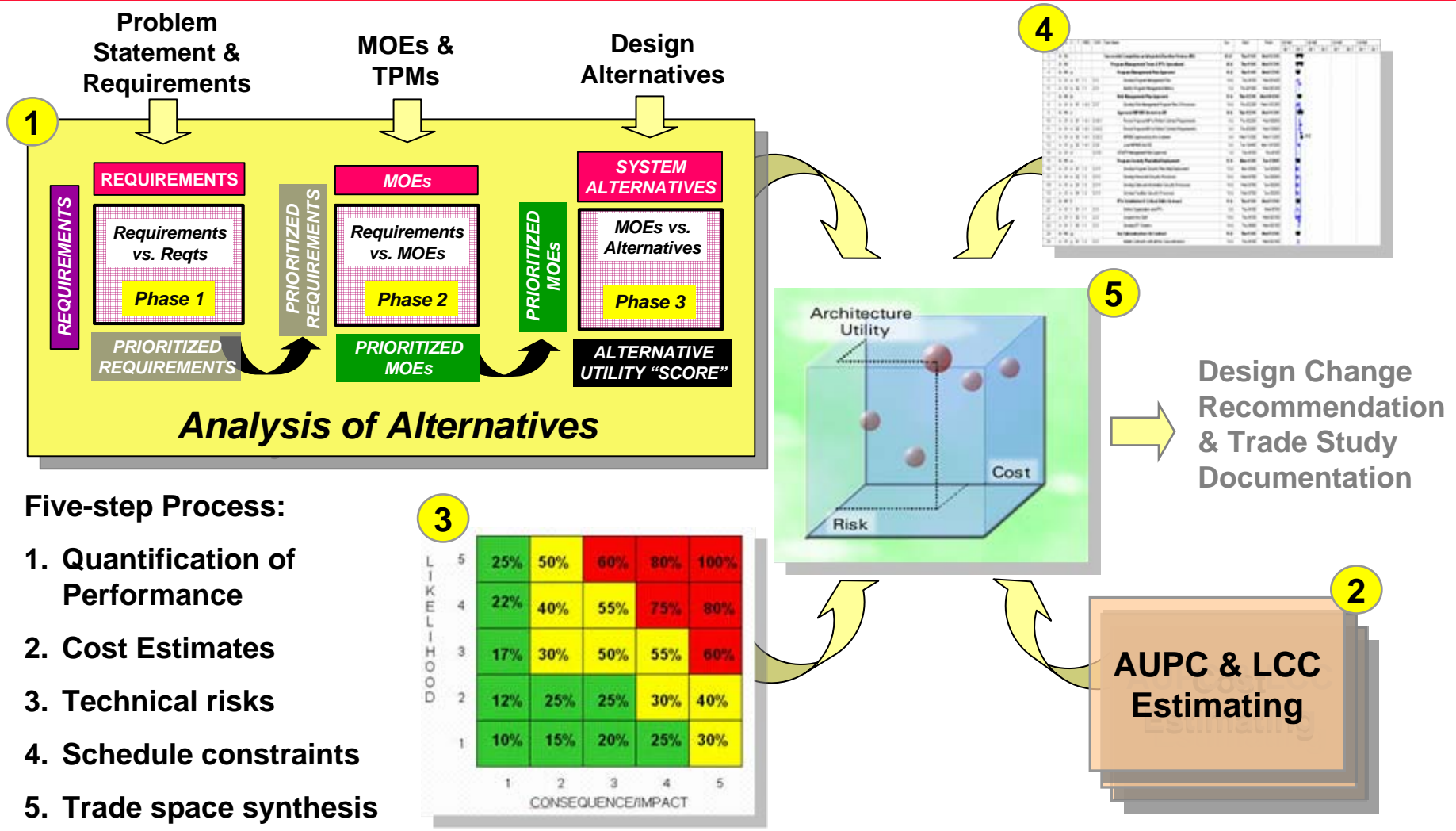


- Nomination
 - IPT's
 - CRI's
- Selection Criteria
 - Potential requirement change
 - Cost driver
 - Risk driver
 - Performance and effectiveness drivers
 - Weight and size drivers

Trade Space Concept



Trade Study Process



Five-step Process:

1. Quantification of Performance
2. Cost Estimates
3. Technical risks
4. Schedule constraints
5. Trade space synthesis

3

5	25%	50%	60%	80%	100%	
4	22%	40%	55%	75%	80%	
3	17%	30%	50%	55%	60%	
2	12%	25%	25%	30%	40%	
1	10%	15%	20%	25%	30%	
		1	2	3	4	5

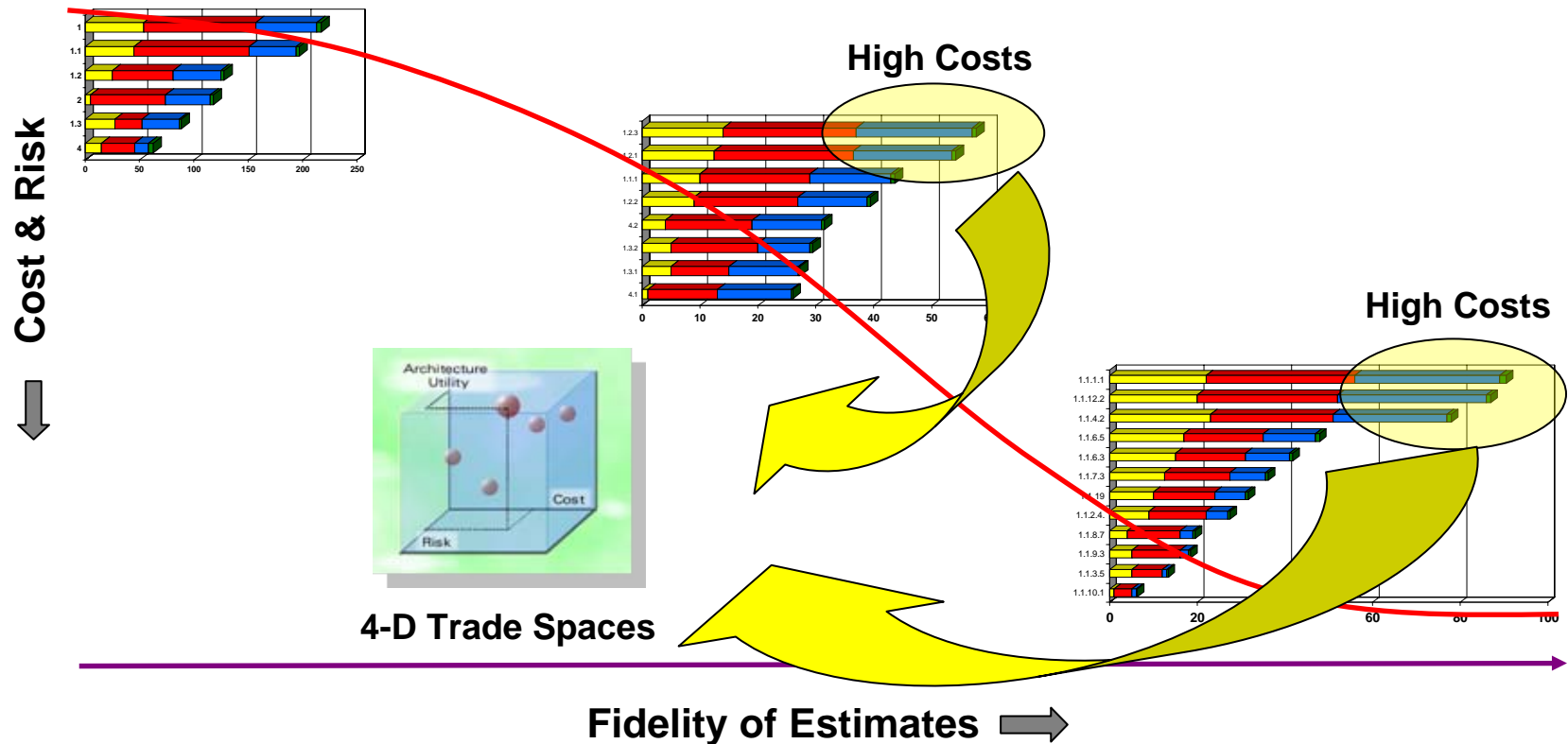
LIKELIHOOD

CONSEQUENCE/IMPACT

4

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50

Pareto Analysis for Visibility and Control



✓ **Continuous Identification of High Cost Drivers and Consistent Lifecycle Cost Tradeoffs Ensures Best Value Design Decisions**

Program Summary of Cost Reduction Initiatives

Open Initiatives as of: date

\$FY03K

Initiative Name	XXX PC Board 1	Initiative Number	32	Level	xx Indenture Level	Estimated Change to AUPC	(\$0.50)
Initiative Type	Cost Reduction Initiative	Start Date	xx/xx/xx	IPT	IPT Name	Est. Change to Unit LCC	(\$1.60)
Description	Change PC Board from custom to commercial						
Initiative Name	XXX PC Board 2	Initiative Number	33	Level	xx Indenture Level	Estimated Change to AUPC	(\$0.50)
Initiative Type	Cost Reduction Initiative	Start Date	xx/xx/xx	IPT	IPT Name	Est. Change to Unit LCC	(\$1.60)
Description	Change PC Board from custom to commercial						

Affordability Reduction Initiatives

Affordability Reduction Database Type	Status	# of Entries	AUPC Value (\$M)	% Change in AUPC
Cost Reduction Initiatives	Pending	6	\$ (25.50)	-2.6%
	Approved	0		
	Total CRIs	6	\$ (25.50)	-2.6%
Weight Reduction Initiatives	Pending	134	\$ (98.40)	-9.8%
	Approved	0		
	Total WRIs	134	\$ (98.40)	-9.8%
Total Reduction Initiatives	Pending	140	\$ (123.90)	-12.4%
	Approved	0	0	0
	Total	140	\$ (123.90)	-12.4%

Example

- Risk is a necessary consideration
- Assess Cost Risk
 - Engineering and design risks
 - Manufacturing risks
 - TRL
 - Supplier risks
 - Maintainability risks
 - Estimating risks
 - Programmatic risks
- Primarily responsibility of functional IPTs

- Objectives
 - to encourage culture change
 - To enable common (and best) practices
 - To assure successful affordability implementation for the program
- Audience: Management (PMs, EMs), IPTs, Subcontractors
- Conducted by Affordability
 - Executive CAIV Affordability Training Class (Management)
 - IPT CAIV / Affordability Training Class (Application)
 - Subcontractor Training Class

- FCS MGV is on track to Meeting CAIV Goals and Targets
- Affordability Plan Is Successfully Being Implemented
- SRR and SFR Were Successfully Completed (SFR March 2006)
- PRICE is an Excellent Model to Conduct CAIV Affordability Analysis
 - Enables Quick Turnarounds Necessary for Trade Studies
 - A Consistent, Solid Basis for Estimates
 - Helps to Find Inconsistencies in Estimates
 - Able to Match Product Structure
 - Facilitate Communications With Technical Folks
 - Well Suited for All Phases of Development Work
 - Outputs Are Easy to Process with Spreadsheets
 - Instituted into Our Culture – Accepted & Reputable

PRICE H Models Are at the Core of Our CAIV Estimating Process