Frontier Technology Inc.

Navy Ship Affordability SBIR For Navy ManTech

17 Jan 2006

Ron Shroder,
Vice President
Decision Support Services

SBIR Topic Overview

- N05-039 TITLE: Technology for Shipbuilding Affordability
- TECHNOLOGY AREAS: Ground/Sea Vehicles, Materials/Processes
- OBJECTIVE: The objective of the project is to develop and implement innovative technologies that will reduce the cost and cycle time to construct, modernize and repair Navy ships.
- DESCRIPTION: The Navy's Program Executive Office for Ships is leveraging the National Shipbuilding Research Program (NSRP) to effect change across the non-nuclear surface shipbuilding, modernization and repair enterprise by coordinating with U.S. shipbuilders to adapt and implement "World Class" commercial best practices in the areas of "Environmental Protection" and "Systems Support Technology Capabilities." Proposals should indicate which of these two research areas is being addressed. Of particular interest are initiatives with a clear business case. Proposals should specifically describe the technology that will be applied to solve the problem, how it will be developed, what the estimated benefits will be and how it might be transitioned into the shipbuilding industry.
- PHASE I: Demonstrate feasibility for improvements being developed and also identify impact upon shipbuilding affordability. Include a first-order Return-On-Investment (ROI) analysis for industry implementation and estimate potential Total Ownership Cost (TOC) reduction. Establish Phase II performance goals and key developmental milestones.
- PHASE II: Finalize the design, as appropriate, and demonstrate a working prototype of the system. Perform laboratory tests to validate the performance characteristics established in Phase I. Develop a detailed plan and method of implementation into a full-scale application.

Related SBIR Topic

N05-053 **TITLE: Modeling the Impact of Technology Transition on Ship Operational Capabilities**

TECHNOLOGY AREAS: Information Systems

ACQUISITION PROGRAM: DD(X)

OBJECTIVE: To develop a technology insertion planning tool that relates ship, system, and technology capabilities to prognostic design variables such as **cost, schedule, and life-cycle factors**.

DESCRIPTION: Concepts such as Total Ship Design and Spiral Technology Insertion and Development involve large numbers of technology trade decisions within a complex and constrained programmatic design environment (cost, schedule, performance). Decisions involve estimates of technology maturity; impact on component, system, or ship performance, development and implementation costs and schedules; and life-cycle factors such as reliability, maintainability, and sustainability.

The Navy desires a decision-support capability that can:

- Identify sets of technologies that should logically be inserted into a ship design at about the same time
- Optimize technology insertion planning as a function of cost, schedule, and performance, and
- Relate ship or systems capabilities as a function of technology insertion

The envisioned toolset of decision-support aides would be used by Navy and prime contractors to support spiral technology insertion and development planning for new ship designs and existing ship modernizations.

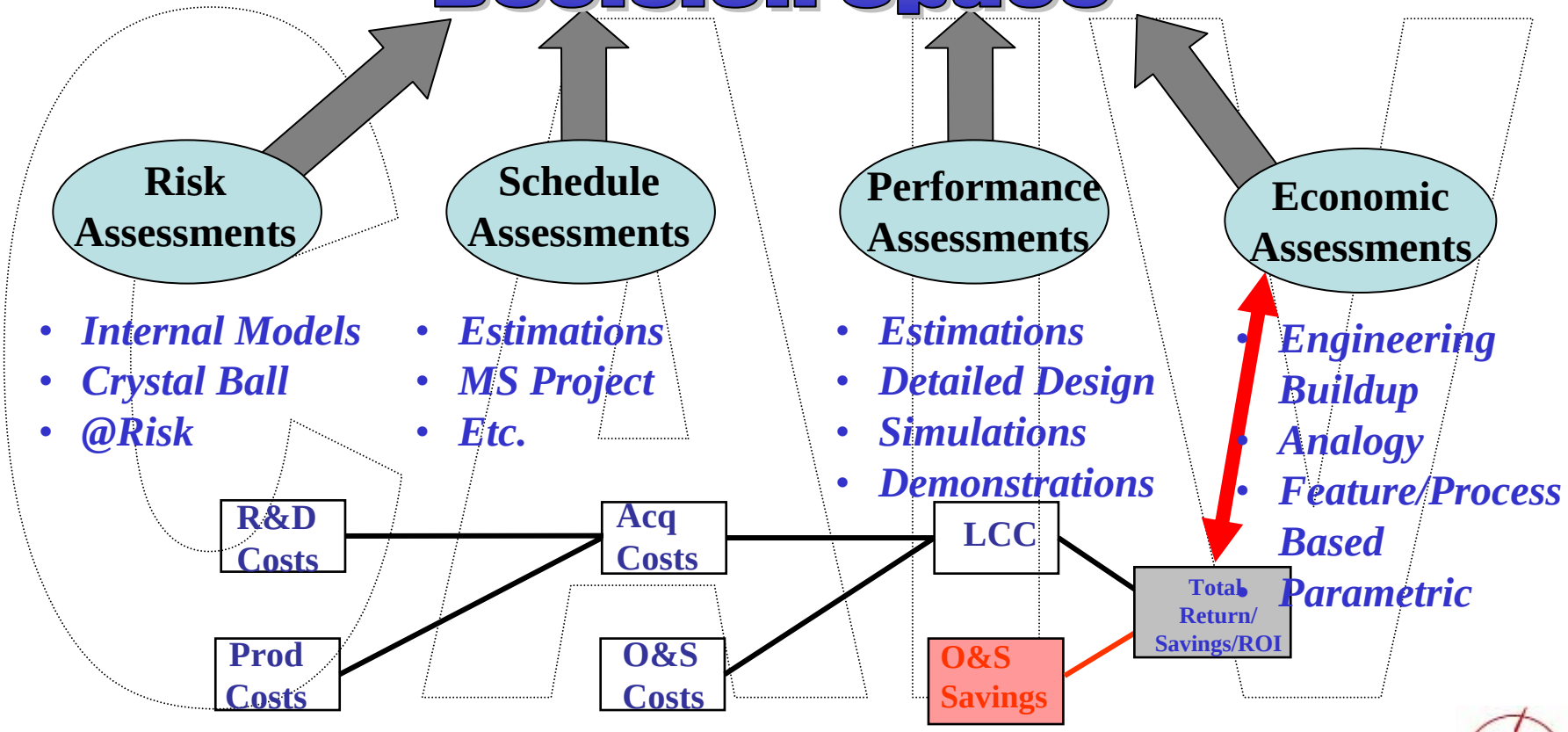
PHASE I: Define and determine the feasibility of the innovative approach proposed for a technology insertion planning tool. Establish validation goals and metrics to analyze the feasibility of the proposed solution. Provide a Phase II development approach and schedule that contains discrete milestones for product development.

PHASE II: Develop a prototype software product based on the results in Phase 1. Utilizing representative inputs/data, demonstrate the viability of the prototype product to perform as projected. Develop testing procedures to measure the effectiveness of the tool and develop a plan for a ship-wide validation exercise. Provide a detailed plan for software certification and validation.

PHASE III: Utilizing the concept developed during Phase I and II, work with Navy and industry to conduct validation testing using real data for a sample system (ship). Use the results of this testing to tailor the decision-support capability to the needs and input capabilities of the DD(X) Program Office in concert with the DD(X) National Design Team.

Overall Program Strategy

Program Justification & Affordability Decision Space



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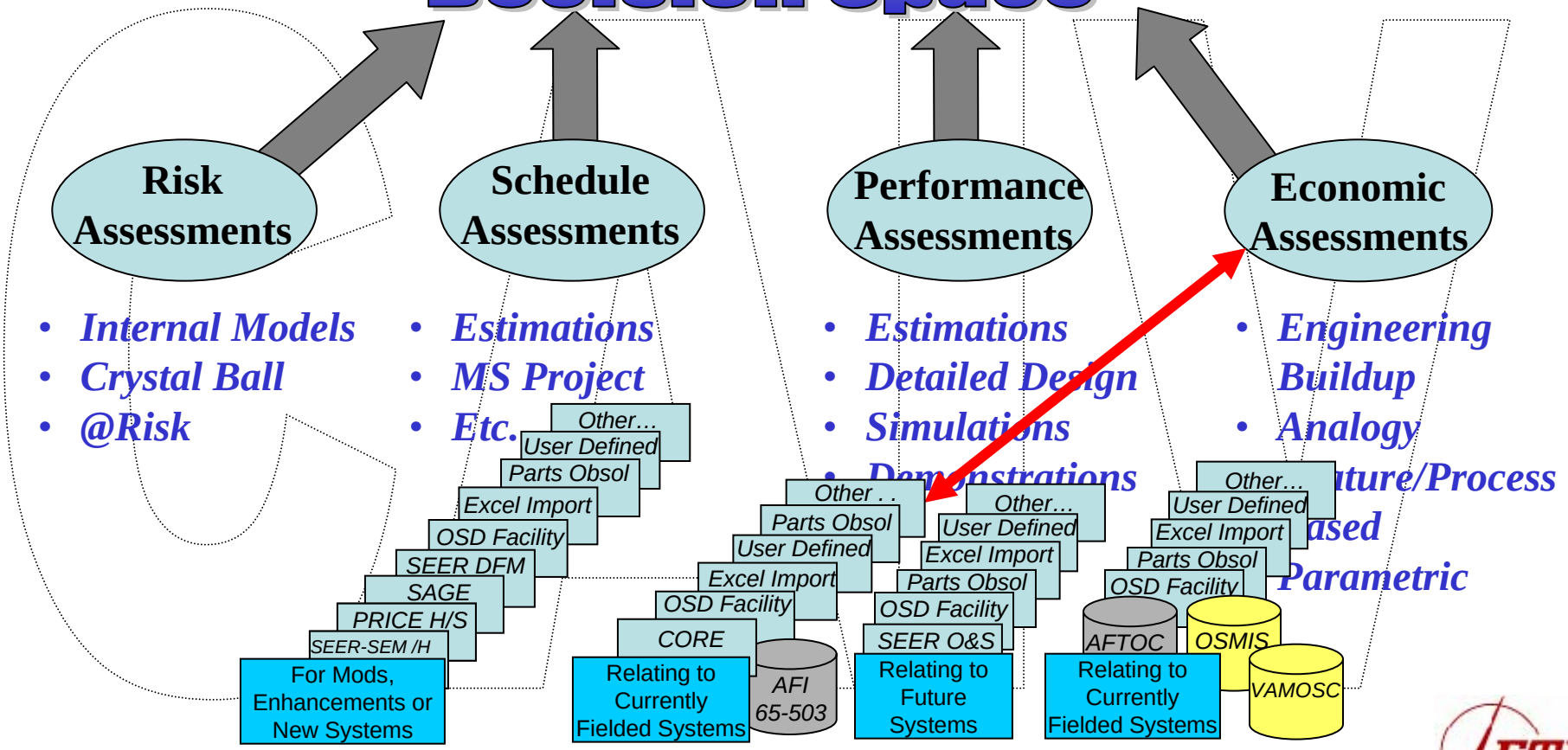
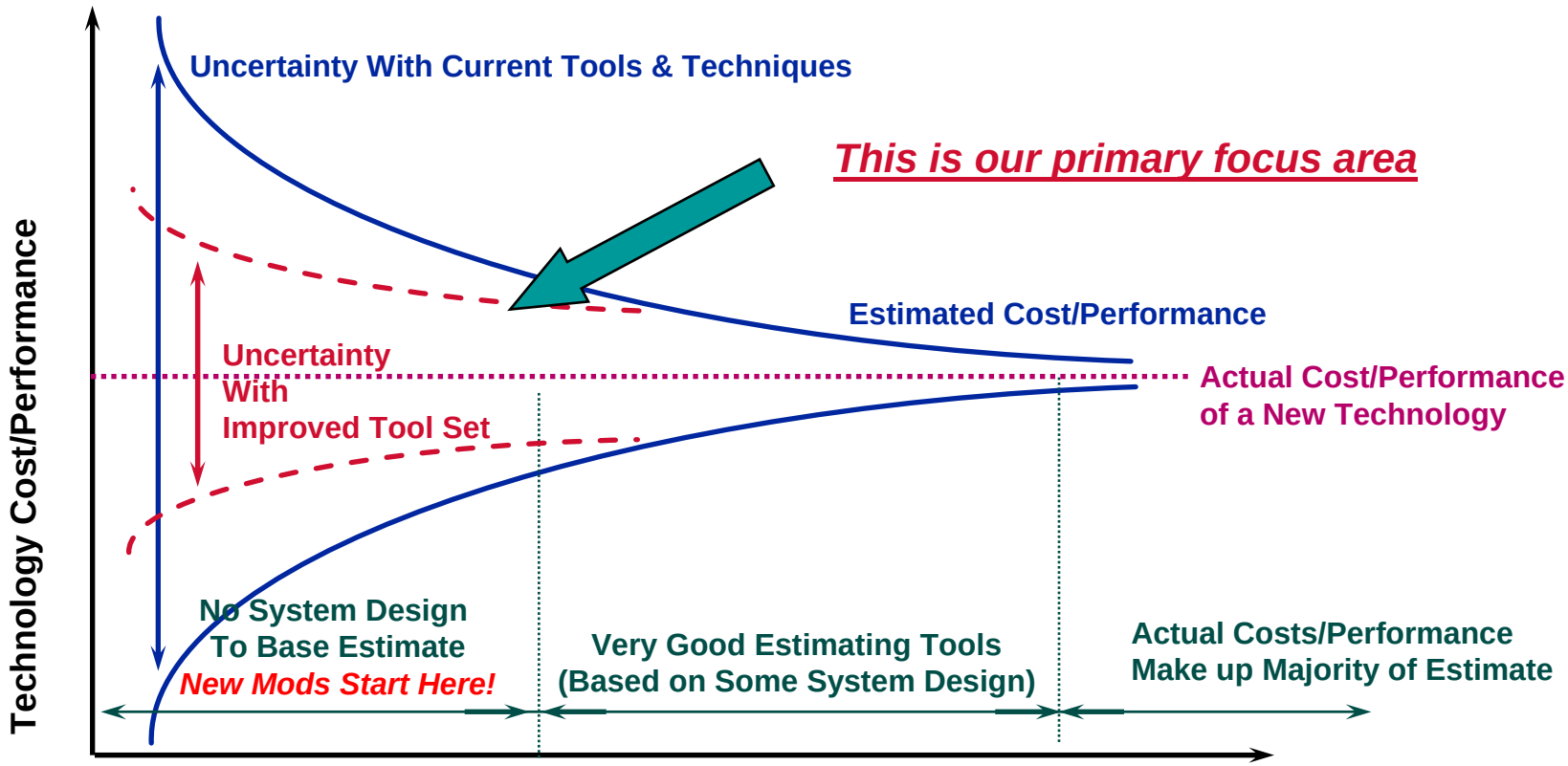


Estimating Methodology



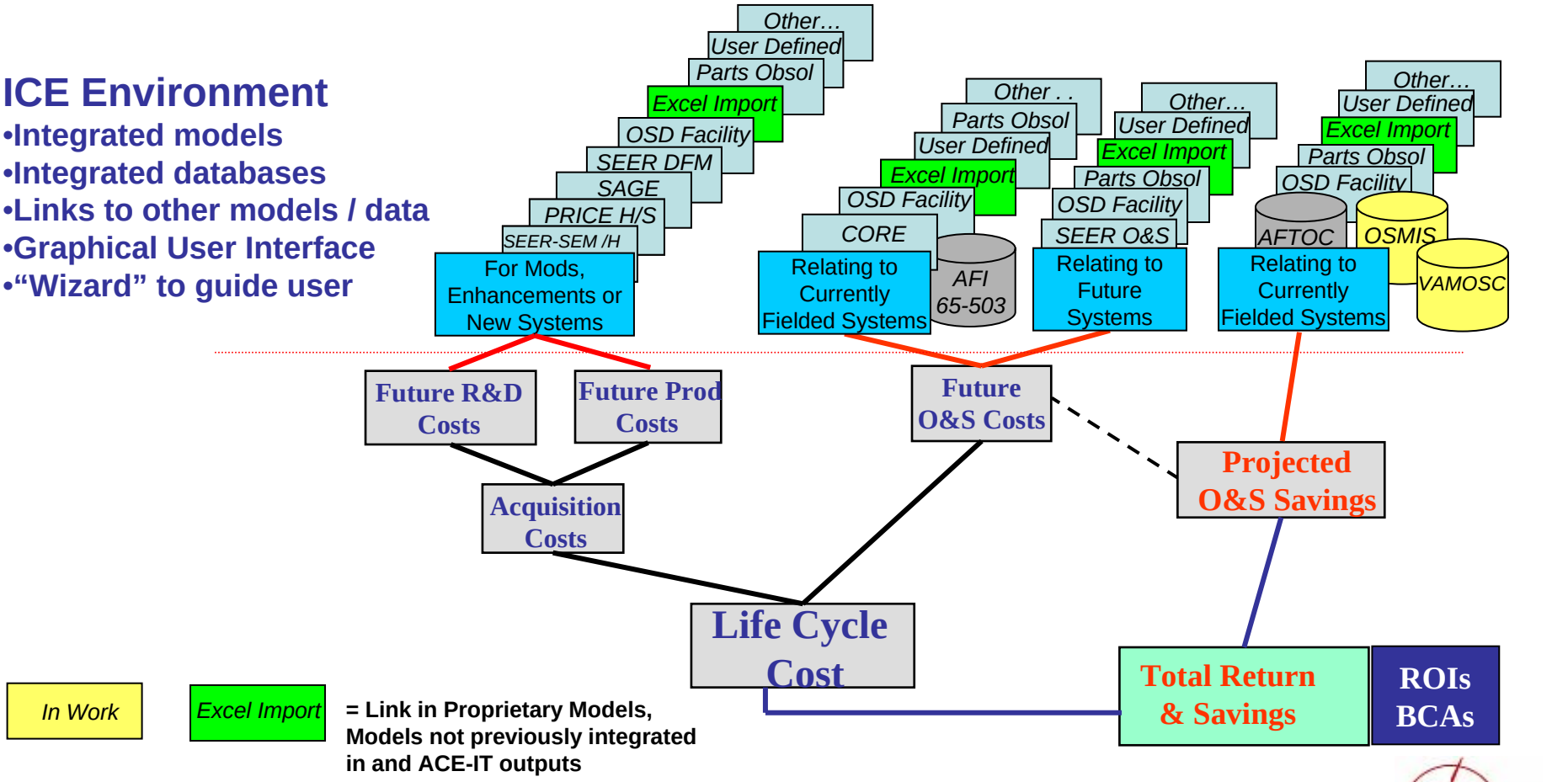
Integrated Cost Estimation (ICE)

An integration of cost tools, models and data

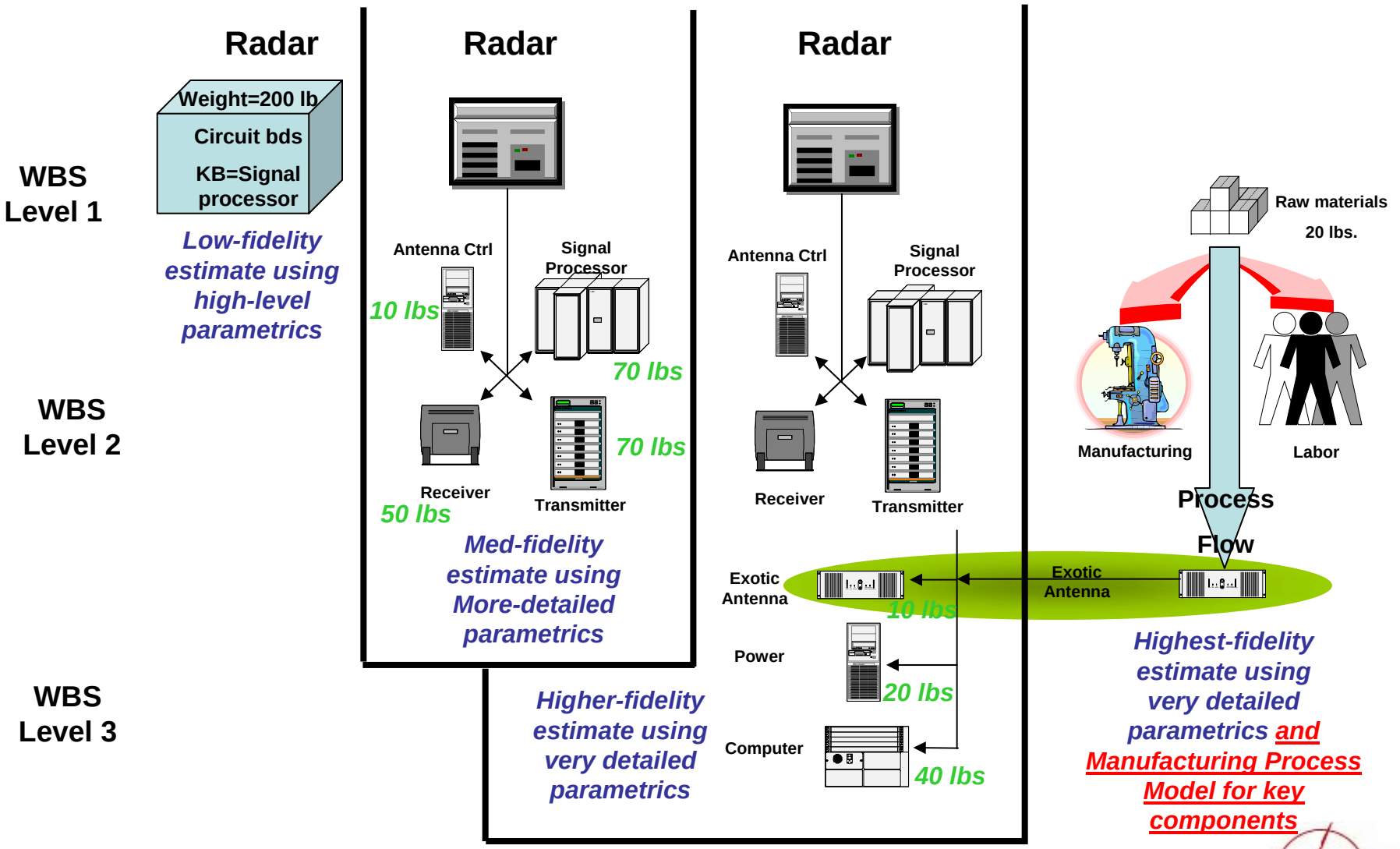
- **Automated cost estimation based on multiple, *accepted* cost models**
- **Provides EMD, production costs, and O&S costs in CAIG format**

ICE Environment

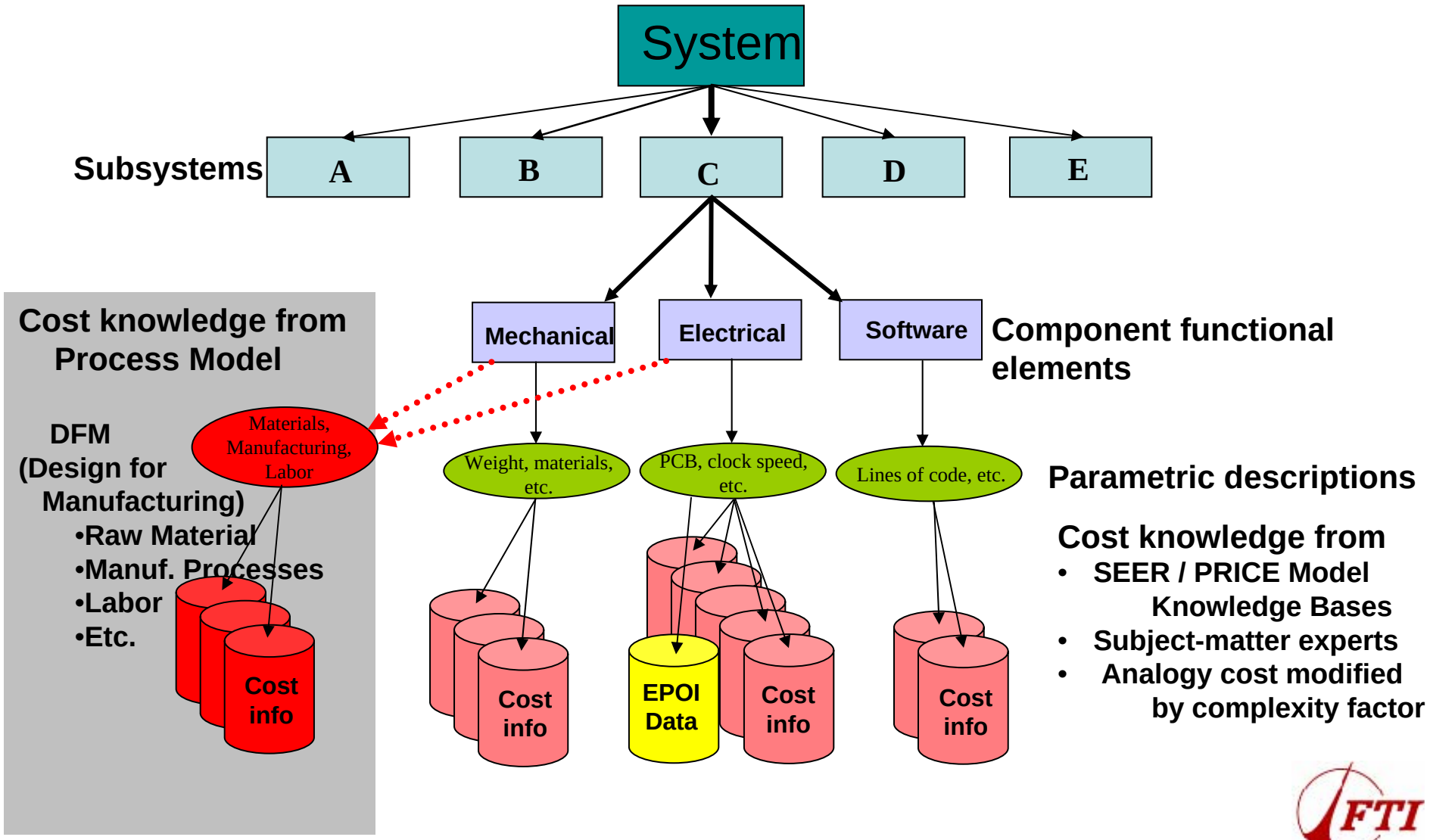
- **Integrated models**
- **Integrated databases**
- **Links to other models / data**
- **Graphical User Interface**
- **"Wizard" to guide user**



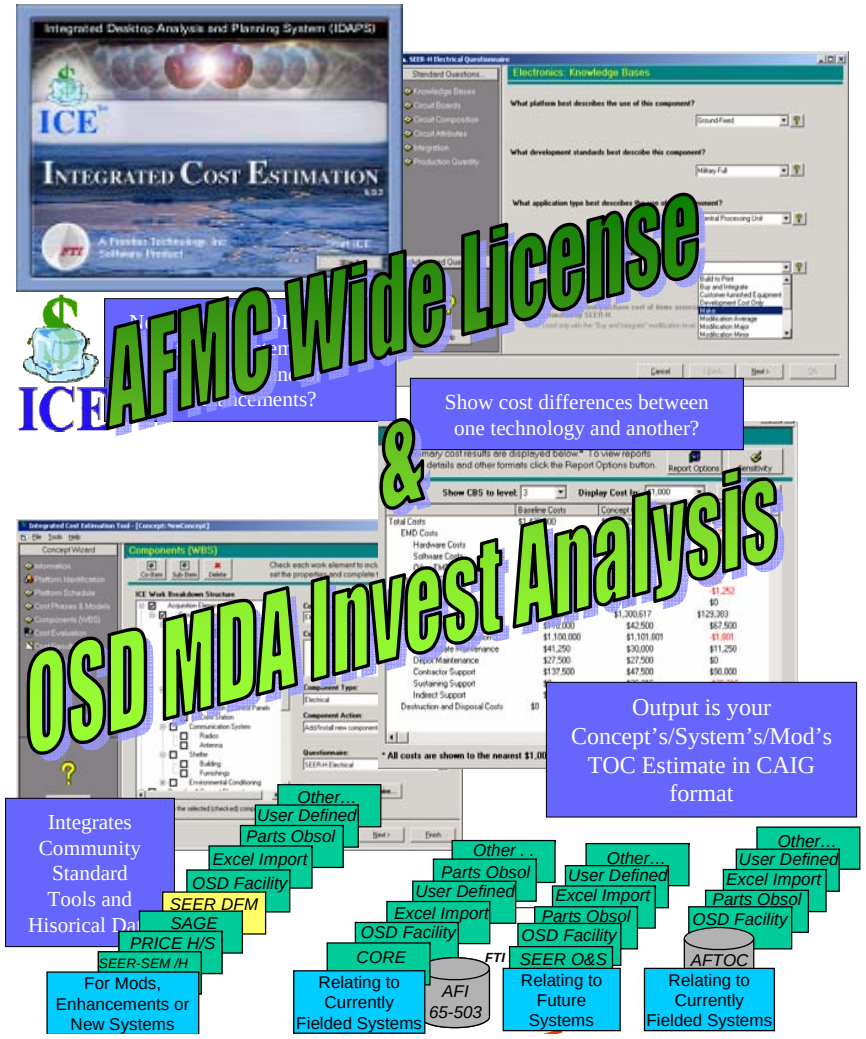
Different Levels of System Decomposition Can Be Used Depending on Cost-Fidelity Desired, Design Maturity, Technology Insertion



Current ICE Operation for Acquisition Costs



IDAPS Integrated Cost Estimate Tool – ICE™

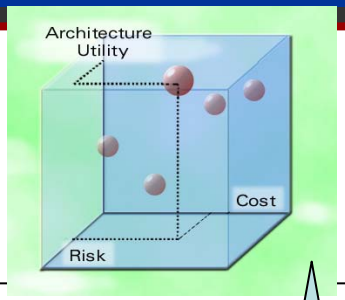


ICE™ is an integrated environment of industry accepted cost estimating toolsets and supporting databases

- **Features**
  - Easy, graphical access to detailed cost models
  - Graphical interface, "wizard" to guide user
  - Change system parameters for quick trades
  - Save multiple concepts to compare alternatives
  - Easy to integrate additional models/databases
- **Benefits**
  - Estimate LCC and ROI of future systems, modifications, enhancements, or technologies
  - Show cost difference between one system alternative and another
  - Proven and accepted by DoD financial management community
  - Use integrated models or user's external or proprietary models and data
  - Quick startup, and limited training

ICE Cost Analysis Process

CAIV
Decision Trade Space



Supports: Life Cycle Cost
O&S Savings
Return-on-investment
Business Case Analysis
CAIV Decision Space

System Concept

Define platform & system components

Work Breakdown Structure

Identify development & production characteristics or processes

Acquisition Cost Models

Cost Model Knowledge Bases

System/Component removal
(unreliable, unneeded, etc.)

DoD Data Systems
(AFTOC, VAMOSC, OSMIS, etc.)

FTI Calculators

Define operations & support

Ops & Support Databases

O&S Cost Models

Execute models

LCC
Savings
ROI
Business Case

Output Reports

Excel Transfer Interface

Customer Models or Data

Subject Matter Expert Input

ICE Graphical User Interface

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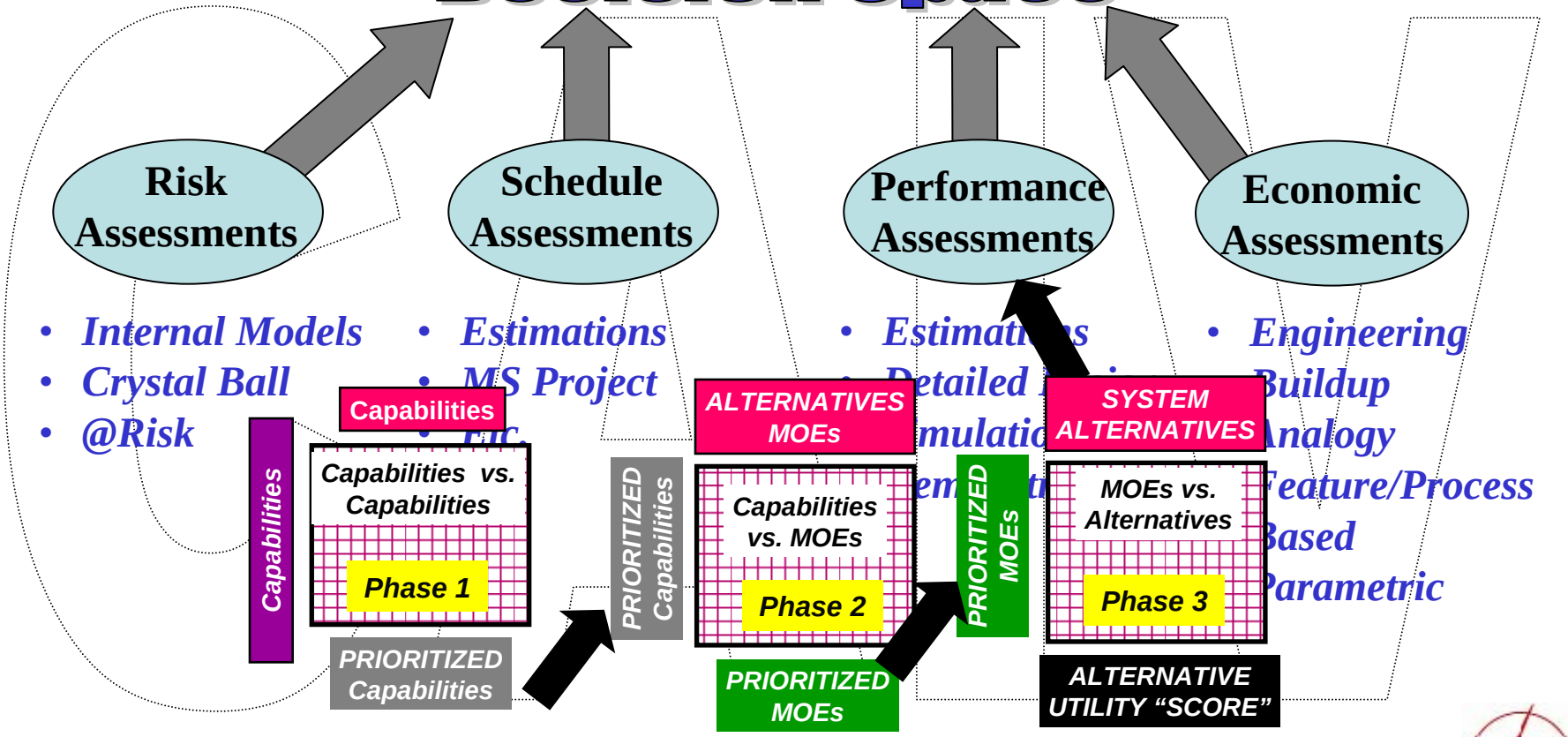
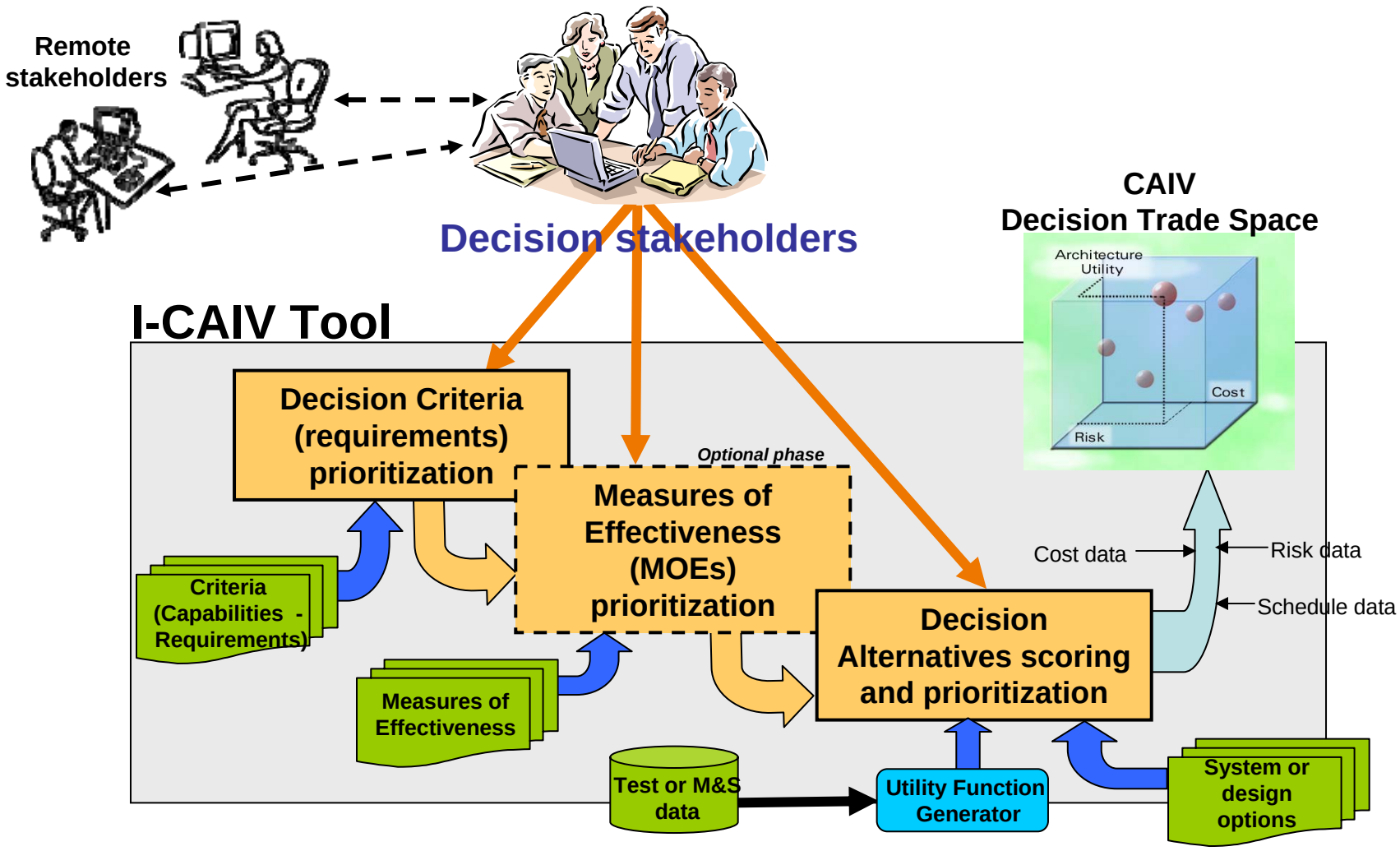


I-CAIV Tool and Evaluation Process



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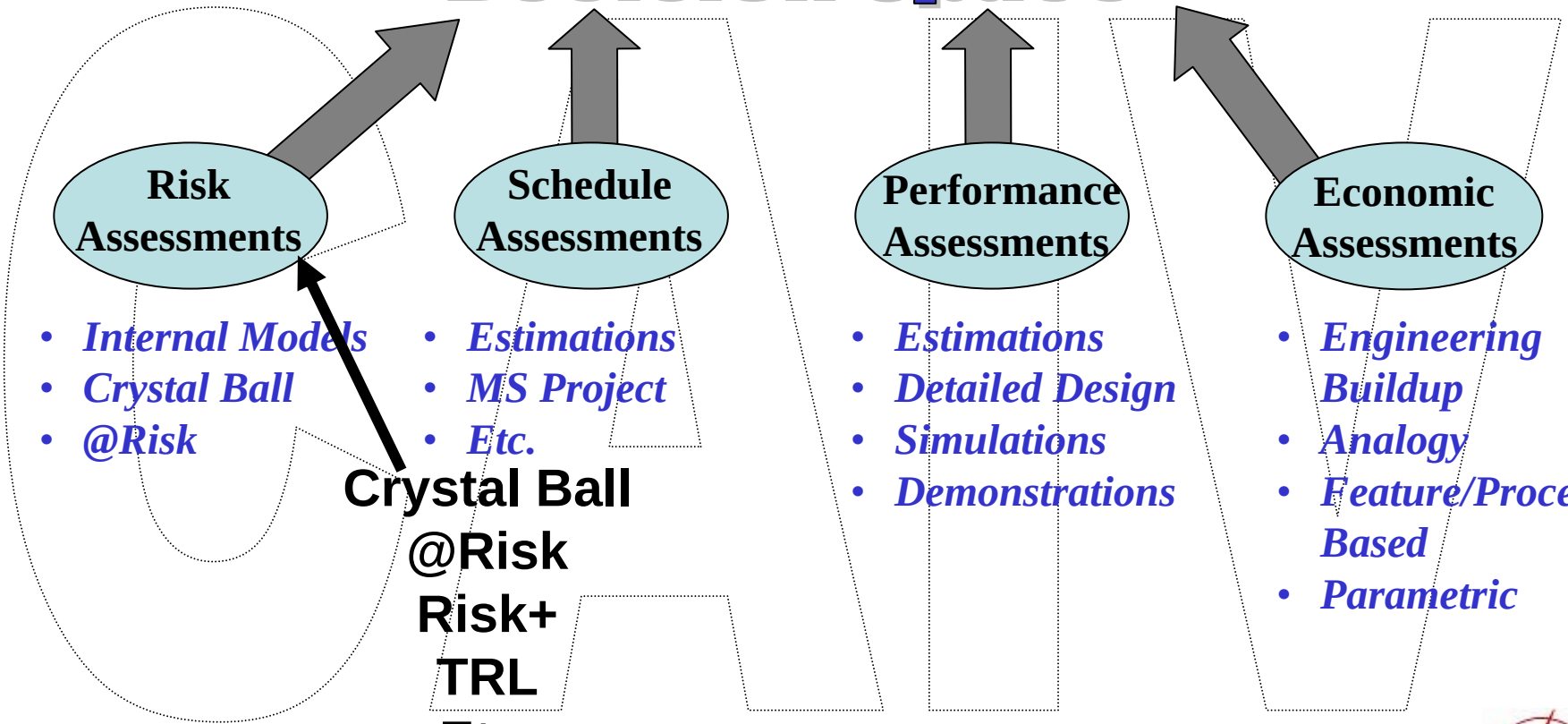
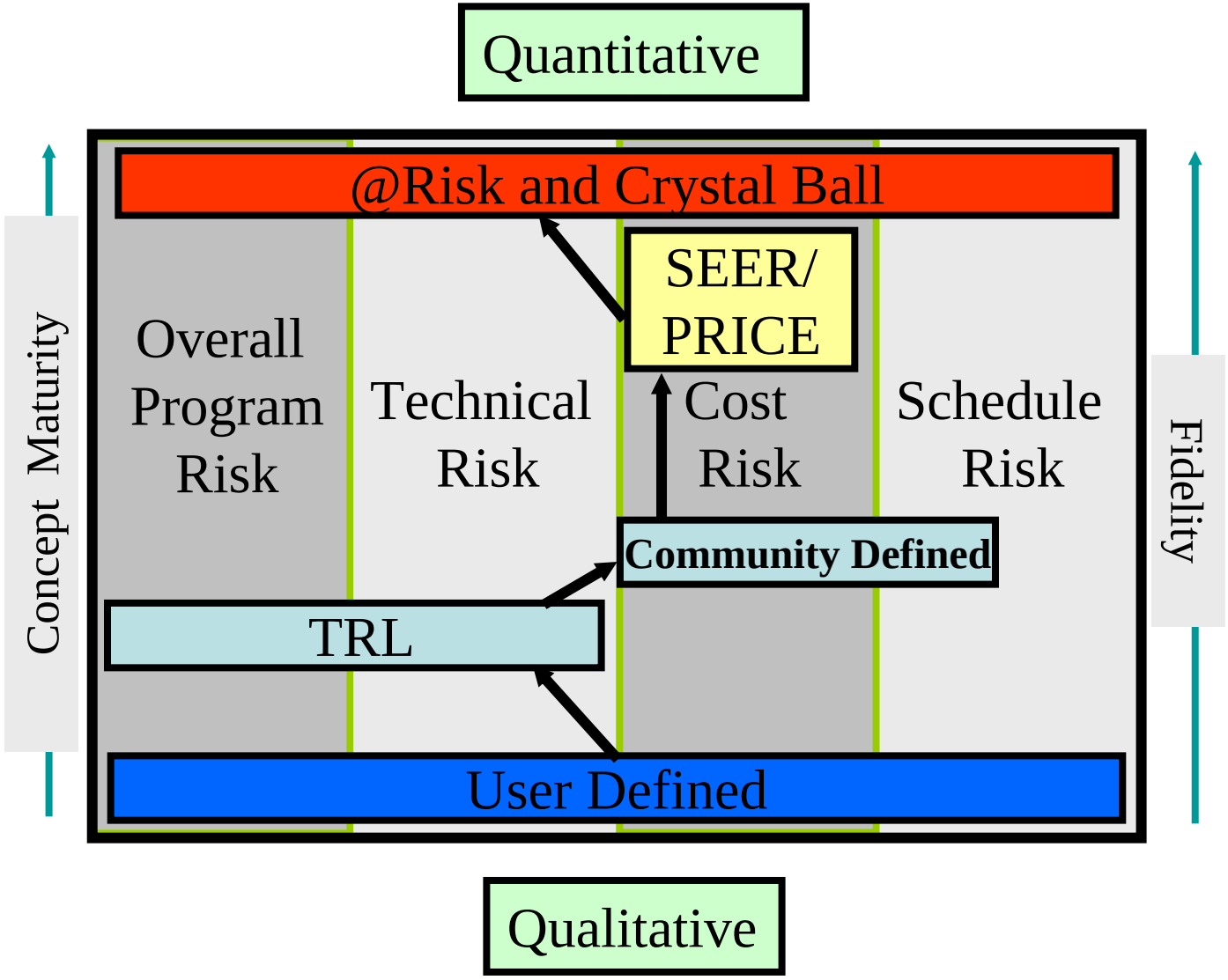
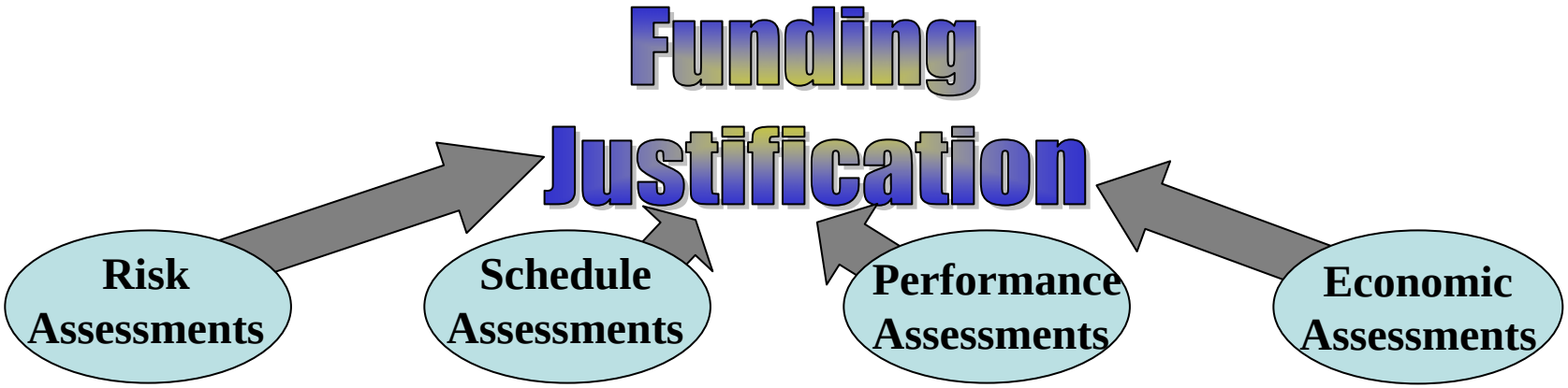


CAIV Risk Approach Roadmap



The Business Case Analysis

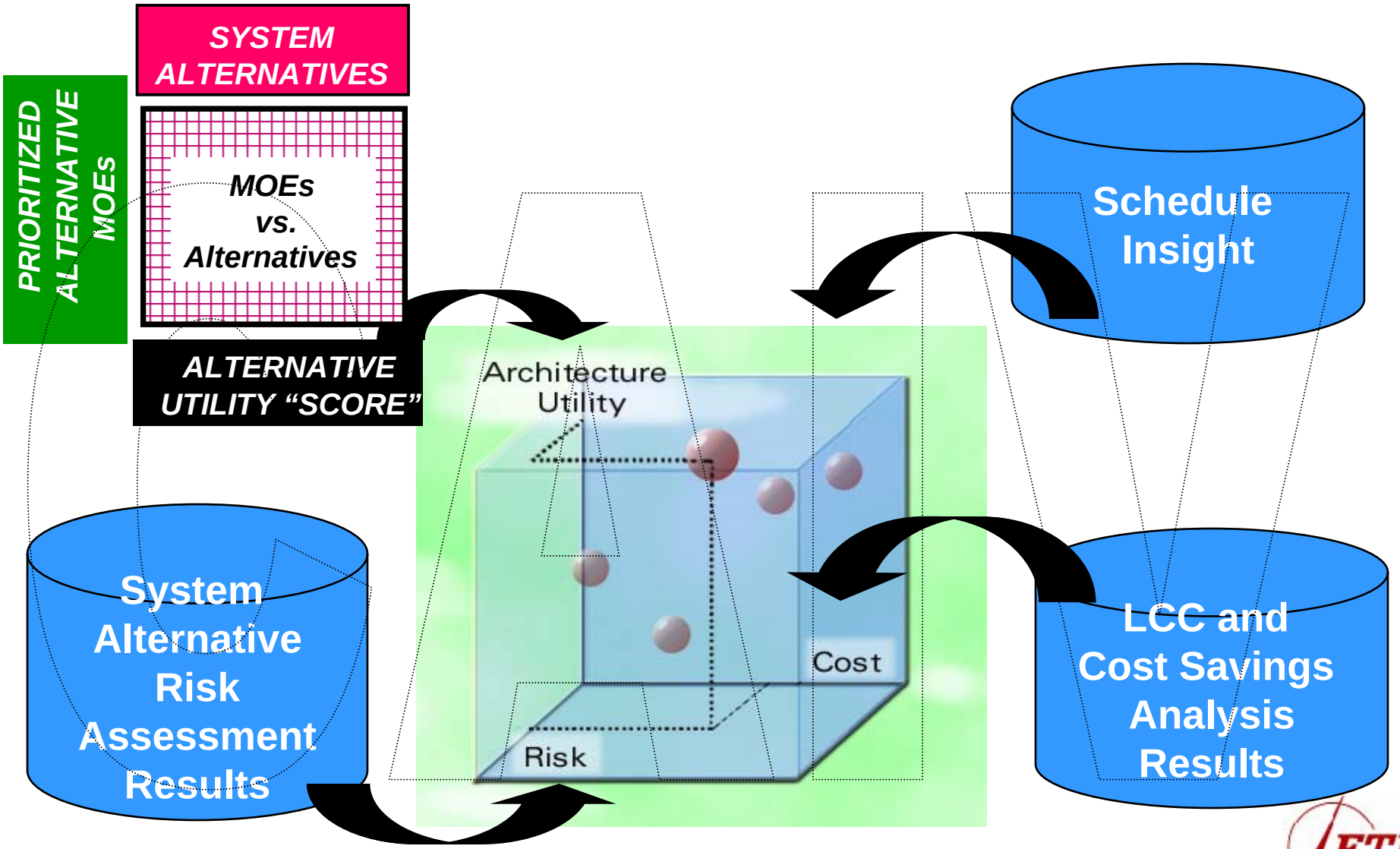
- A Business Case Analysis is an Economic Analysis of the program to include a Return-on-Investment evaluation of the system life-cycle costs
- Content may vary depending on fidelity desired
  - DoD R-TOC BCA template contains primarily economic ROI
  - A robust BCA includes evaluation of system utility (or performance) to enable judgments of best-value alternatives



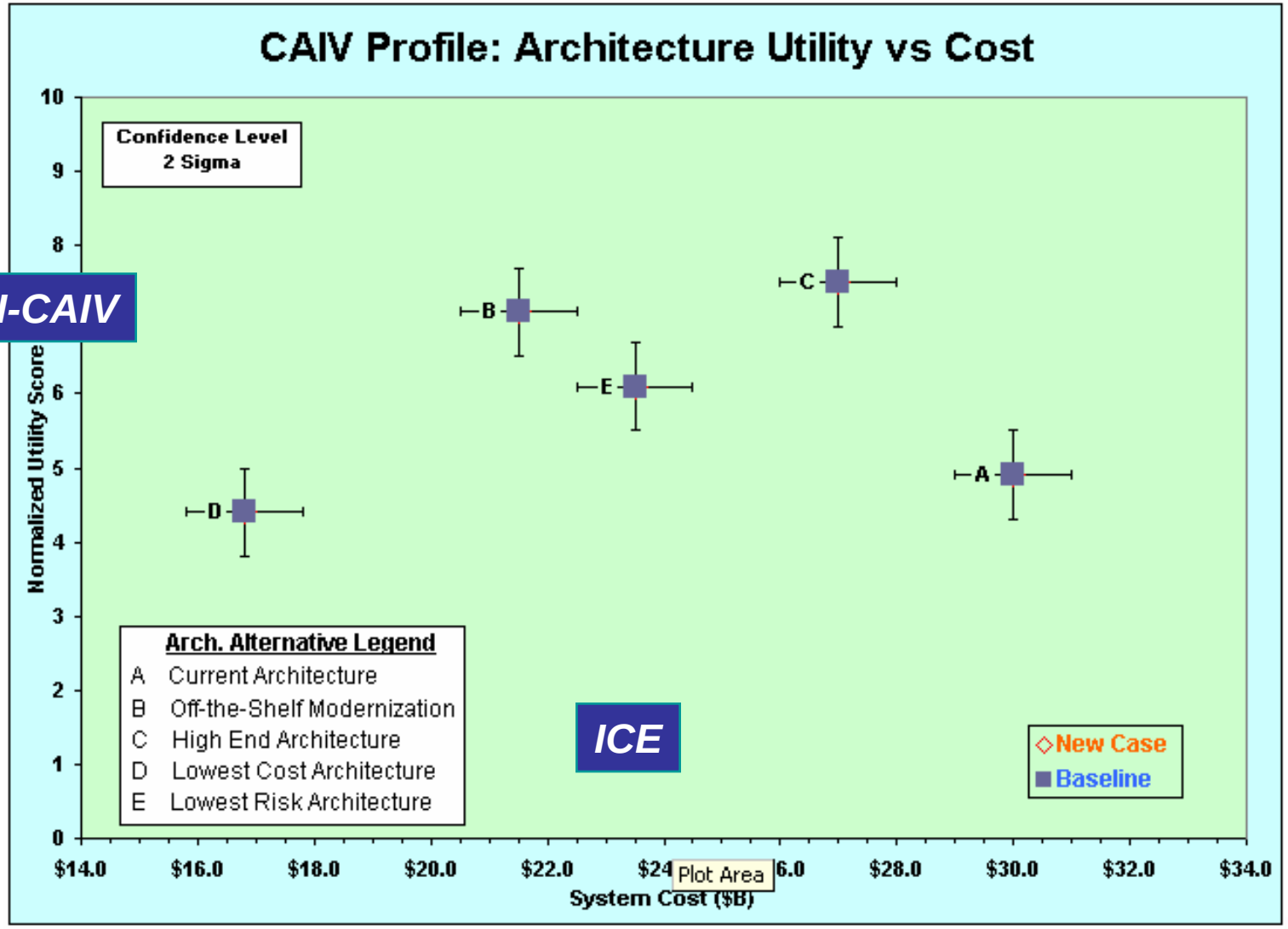
BCA provides a structured methodology and analysis to understand the four basic elements of an acquisition decision. The BCA enables senior decision-makers to consider best balance of life-cycle cost, performance, schedule, and risk, measured against customer criteria, priorities and capability requirements.

The BCA helps decision-maker balance cost, performance, schedule and risk in selection of best-value alternatives

CAIV Vision for Decision Support



Bring Traceability into the Decision Making Process



Phase 1 Focus

- PEO Ships Priorities for Affordability & Economic Analysis
  - Focus on offensive/defensive mission affordability analysis
  - Desirable products:
    - Cost vs. benefit summary
    - Business Case Analysis
    - Cost driver summary (linked to MOE performance)
    - CAIV profile linked to Objectives and Threshold performance
- Navy Affordability Trade Parameters
  - Criteria & Measures for ship systems (i.e., propulsion)
  - Criteria & Measures for network and computer optimization
- Navy Cost Databases
  - Ship sustainment cost models
  - Development & Production cost factors
  - Assessment of VAMOSC applicability

NG Ship Systems (NGSS) Participation

- Phase 1
  - Support data collection efforts
  - Insight into ship system cost drivers and sustainment factors
  - Support Affordability Tool Suite proof of concept beta-testing
  - Insight into National Shipbuilding Research Program (NSRP) priorities and applicable analysis
  - Endorsed the concept
  - *Clearly Demonstrate Value of Applying Affordability Tools to PEO Ships Economic and Performance Decisions*
  - NGSS sought to use it on their own programs, and have requested it get briefed at a NG Corporate Systems Engineering Forum
- Phase 2
  - Assist in defining the requirements
  - Use the system

October 04, 2005

MEMORANDUM FOR Mr. William Palko, NAVSEA Code 6101

SUBJECT: Letter of Interest for Small Business Innovation Research (SBIR) Effort – Technology for Shipbuilding Affordability

I have reviewed detailed Ship System examples of the affordability methodology developed by Frontier Technology, Inc., and the ICE and I-CAIV computer tools that are used in conjunction with the methodology. The tools provide the initial foundation of an infrastructure that could continue to be tailored for conduct of formal ship system trade studies as well as determination of Total Ownership Cost (TOC). Of particular interest is the ability to determine TOC and related concept Life Cycle Cost (LCC) for potential design alternatives without needing to involve the detailed cost and pricing teams on every step for each alternative. The FTI affordability methodology facilitates the use of community accepted cost data sources—which can increase the engineering insight into potential LCC issues earlier in the design trade process while not burdening the other cost and pricing staff with multiple, evolving solutions.

The Phase II research that FTI will be proposing will mature these tools further, and will develop and implement an effective methodology for affordability evaluations of shipbuilding and sustainment technologies. This is extremely important given the desire for more comprehensive analysis with limited technical resources. The tool set allows engineering staff to be more efficient and accomplish more analysis by providing an environment where applicable data sources are integrated into the desktop environment and the tools leverage existing NG Ship System processes. The Phase II effort will allow additional ship oriented data sources to be integrated into the tool suite.

I understand the unique value of the FTI affordability methodology and believe the Phase II effort will enable creation of a much needed infrastructure for affordability assessments. I wholeheartedly endorse continuing the development into a Phase II effort. Please contact me if you have any questions or need additional justification regarding this important effort. I can be reached at 228-872-7568.

Sincerely,

Garth Turner
Senior Engineer
Research & Development

Date: October 4, 2005

To: Mr. William Palko, NAVSEA Code 6101

Subject: NGSS Systems Engineering Letter of Interest for Small Business Innovation Research (SBIR) Effort – Technology for Shipbuilding Affordability

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The NGSS Systems Engineering Leadership Team has reviewed the detailed Ship System ICE and I-CAIV affordability methodology computer tools developed by Frontier Technology, Inc. These tools are consistent with the NGSS Systems Engineering Total Ownership Cost (TOC), Design to Cost (DTC) and the Cost As an Independent Variable (CAIV) philosophies and actually provide areas of automation related to the up front requirements decomposition and traceability to Navy performance objectives and thresholds.

Of particular interest is the ability to create a decision support environment that links stakeholder needs, expectations and priorities to capabilities to expected performance levels. This environment also facilitates the integration of concept cost, risk and schedule aspects of different design solutions that is a key component of the early phase of the System Engineering life cycle. The FTI affordability methodology facilitates the implementation of a structured analysis approach based on industry standard techniques and methods. NGSS Systems Engineering is very interested in seeing the FTI research continued in a Phase II effort. The research that FTI will be proposing will mature these tools further, and will develop and implement an effective methodology for affordability analysis that is synergistic with NGSS Systems Engineering vision and objectives. Specifically, an area of future research will be the development of analytical methods to support "Design to Cost" exercises.

One area of focus will be to mature the mathematical equations that represent performance curves related to key ship cost drivers to further automate the ability to consider Design to Cost and related Cost As an Independent Variable (CAIV) analysis. An automated affordability tool set with libraries of ship system data is critical to the ability to provide the necessary insight into the cost versus performance on existing and future Navy Ship programs. The Phase II effort will allow additional ship oriented data sources to be integrated into the tool suite and will establish initial libraries of applicable ship system analysis parameters. The resulting tool suite is of interest not only to NGSS, but also is applicable to affordability analysis being conducted by the other six Sectors of Northrop Grumman.

In my position as the head of NGSS Systems Engineering and its associated Community of Practices (COP), I am very interested in applying this evolving methodology to help solve real world Systems Engineering issues. I wholeheartedly endorse continuing the development into a Phase II effort. Please contact me if you have any questions or need additional justification regarding this important effort. I can be reached at 228-872-7584.

Sincerely,

Robert C. Rifley, CSP
Manager, NGSS Systems Engineering

NORTHROP GRUMMAN

Northrop Grumman Corporation
Ship Systems

PO Box 149
Pascagoula, Mississippi 39568-0149

A-05-62-211
October 5, 2005

Frontier Technologies, Incorporated (FTI)
26 Castilian Drive
Suite B
Goleta, CA 93117-3207

Attention: Ron Shroder and Iva Heins

Subject: NGSS Support for FTI's SBIR N05-039 Proposal

Northrop Grumman Ship Systems, Inc. (NGSS) is pleased to support your Phase II SBIR proposal to the US Navy. Having reviewed FTI's Cost Analysis Software in the Phase I effort, and having determined the software could provide much needed structure to the engineering trade analysis environment; NGSS gladly supports FTI in Phase II.

As you are aware, NGSS headquartered in Pascagoula, Mississippi, is one of the nation's leading shipbuilding full service systems companies. We perform design, engineering, construction, and life cycle support of major surface ships for the U.S. Navy, U.S. Coast Guard and international navies, and for commercial vessels of all types.

Should FTI be successful in receiving a Phase II award, NGSS is interested in supporting that effort as a Subcontractor subject to receipt of a mutually agreeable FTI Purchase Order with an acceptable 2 way Non-Disclosure Agreement included in the Purchase Order.

Good Luck.

Very Truly Yours,

Michael J. Kitchen, Director
Contract Administration

FTI
NORTHROP GRUMMAN

-----Original Message-----
From: Bakotic, Mark E. (Ship Systems) [mailto:Mark.Bakotic@ngc.com]
Sent: Thursday, September 29, 2005 2:47 PM
To: Bell, William B CIV NSWCCD W. Bethesda, 2100
Cc: Flitter Lance A CRBE; Gregory Glenn E CRBE; Fox, Elizabeth (CSC)
Subject: RE: Mid-project review: SBIR N05-053 - Modeling the Impact of Technology Transition on Ship Operational Capabilities

Bill,

I stand corrected. I guess that it is possible for integration of COST, SCHEDULE, PERFORMANCE and RISK into a Technology Insertion Tool with the funding of one SBIR award. I just saw it.

Under SBIR (NSRP) Topic N05-039 (Technology for Shipbuilding Affordability) Frontier Technology, Inc is working on a Phase I effort in cooperation with NGSS. The product is a decision making tool that encircles Cost, Schedule, Performance and Risk. The fruit of their work in the result of $20M-$25M invested by other organizations (esp. aerospace) and being converted into a shipbuilder's tool. It captures the system engineering process and integrates all of the requirements into a massive spreadsheet on steroids. Their product is already a TURBO TAX-like (i.e., user friendly GUI with drop down menus) tool that is 90% of what we are looking for. Because it is a decision making tool, it works nicely for optimization. It can receive data from various formal databases that it has already been integrated into the tool, but it can also directly receive data from an excel spreadsheet.

In addition, they have been working on an OM sub-set of the cost analysis pillar with hooks already in place for some of the government OM web-based databases. They plan to submit on the OM tool in the next SBIR round.

The Government TPOC for N05-039 is William A. Palko NSWC CD at (301) 227-4968 or (202) 781-1732.

When asked why they didn't submit for the TI SBIR they said that they had a limited number of resources to pull the proposal together and thought that they had a better chance of getting the Phase I award for the shipbuilding affordability topic because of past interfaces with Palko. I worry that in a "general area" they might not compete as well as they might have under the more exact TI Topic. I recommend that you and Lance look at it and think of it as a seven Phase I winner for the PEO Ship Topic N05-053. Friends aside, they might have the entire package which only needs the polishing of the apple to complete the tool for our use.

VR

Mark

Jerry Tuttle

From: Jerry Tuttle [mailto:jt@sseusa.com]
Sent: Tuesday, September 20, 2005 6:27 AM
To: Teel, Phil A. (Ship Systems)
Subject: Mélange

. . . . recommend to you that you strongly endorse a Small Business Innovation Research Project (SBIR) that will result in a software tool suite that will immediately quantify the salient factors that affect ship system affordability and give NGC a competitive advantage in ship construction.

. . .a SBIR phase II project for the instantaneous calculation of cost as a function of independent variables, e.g. performance/utility/requirements, risk assessments, life-cycle cost estimates, schedule constants, etc. I have vetted the company, Frontier Technology Inc. (FTI), which has completed phase I for integrity and find General Jerome Landry, USAF, ret. And Colonel Ed Palmquist, USMC, ret. to be as pure as Mother Teresa. From a performance, utility and value added perspective, the methodology and tool suite apodictically have demonstrated their mettle with the U.S. Air Force and BAE in its Littoral Combat Ship proposal. . . . the potential benefits that would result would be galactic and the consequences epic. The FTI and Northrop Grumman team will use the money to improve decision making for PEO Ships. I veritably cannot envision a greater return on investment than what this capability represents. You would be the benefactor. Lastly, I confess to my bias, because I had planned to exploit a like capability to brief congress on the various variables for the Joint Strike Fighter, i.e. LO, speed, range, agility, vulnerability, survivability, cost, etc., but I reached 40 years in the canoe club before I had the opportunity. Attached is a draft of a proposed letter to Mr. William Palko, NAVSEA Code 6101 that I recommend in the strongest possible terms that you sign.

Kindest regards,

Jerry

Applicability

- USAF
  - Across AFMC
    - Program Offices
    - Lab
      - Including ManTech
  - ISC2
  - AOC and more
- MDA
  - Investment Analysis
- Army Programs
  - FCS
  - WIN T
- Navy
  - LCS
  - PEO Ships
  - Pax River
- Boeing
  - FCS
- Lockheed Martin
  - ISC2
  - Black World and more
- Northrop Grumman
  - NASA
  - Aircraft Studies
- GD
- BAE
- ITT
- And more

Sample Affordability Products

- Discuss potential value and structure of the following affordability products:
  - Cost vs benefit summary
  - Business Case Analysis
  - Cost driver summary (linked to MOE performance)
  - CAIV profile linked to Objectives and Threshold performance

FTI Teaches ICE™ and Affordability at Defense Acquisition University

Signing of DAU and FTI Letter of Intent on February 16, 2001. Seated from far right: Lavon Jordan, CEO, Frontier Technology, Inc.; Frank Anderson, Jr., DAU President, Spiros G. Pallas, Principal Deputy to the Director, Strategic and Tactical Systems, OUSD (AT&L);. Standing from left: Scoop Cooper, Frontier Technology; Paul McMahon, Director of Strategic Partnerships, DAU; Ron Shroder, Vice-President, Frontier Technology.

Industry and government partner on cutting-edge, cost-conscious defense education and training programs

SANTA BARBARA, CA - March 19, 2001 - In a recent ceremony at the Pentagon office of Dr. Spiros Pallas, Principal Deputy to the Director, Strategic and Tactical Systems, FTI and the Defense Acquisition University (DAU) signed a letter of intent calling for FTI to provide training to the U.S. Department of Defense workforce in the area of systems acquisition. DAU is the corporate university for acquisition training in the Department of Defense.

FTI has developed and will teach an elective for the Advanced Program Management Course (APMC) on cost estimating for the Defense Systems Management College, one of the in-residence instructional institutions for Defense Acquisition University. In fiscal year 2000, the DAU trained 40,723 students from the Air Force, Army, and Navy.

The course is based on FTI's development of a flexible system of integrated cost-analysis software models and data called ICE™, which enables users to estimate life-cycle cost and return on investment. "This new elective course introduces automated tools to replace the more time-consuming process of estimating costs by hand," explained Lavon Jordan, CEO for FTI. "Much of the credit for this training program belongs to Brigadier General Frank Anderson (retired), for his vision in recognizing the need to reduce operating costs and reliably assess system life-cycle costs and affordability before committing funds," Jordan added. Anderson is president of Defense Acquisition University, based in Fort Belvoir, Virginia.

Summary

- Effective tools and methodology are ***immediately*** available to enable affordability to be a key part of the decision process
  - ICE - integrated environment of the communities' accepted cost estimating tools
  - I-CAIV - decision aid tool to integrate critical factors, related to warfighter priorities
- Enables USN and Ship Building Program Managers, Engineers and Scientists to have quick insight into estimated cost, return-on-investment, BCA's and utility
- Interested in assuring USN, USAF, OSD, and others' investments maximizes benefit to the Navy and Ship Building organizations
- Looking forward to ***enhancing*** the system as part of the potential Phase 2 SBIR to integrate it even more with the existing Navy data sources