Optimization in support of Missile Defense Investment Decisions

2007 ISPA-SCEA Conference
and Workshop

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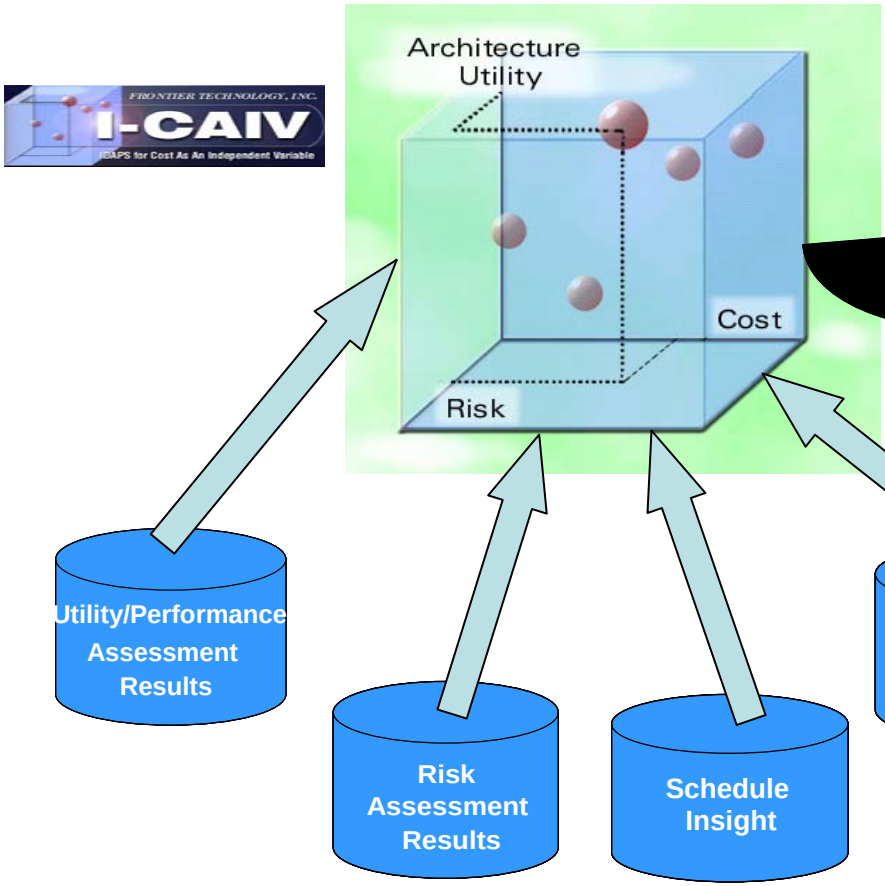
Research Objectives

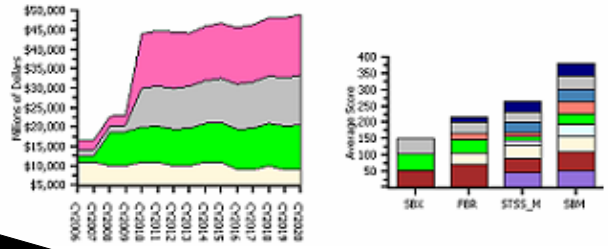
- Develop a distributed Investment Analysis System for MDA
- Develop a methodology and tool set, integrating key elements of FTI and MDA/DOBI methods and tools as appropriate
- Develop a resource optimization capability
- Demonstrate the benefits of the methodology and tools in a realistic problem environment
- Develop / deliver final prototype capability
- Commercialize software tools

FTI Tools Tailored for MDA Investment Analysis

Technology/System Investment Trade-Space



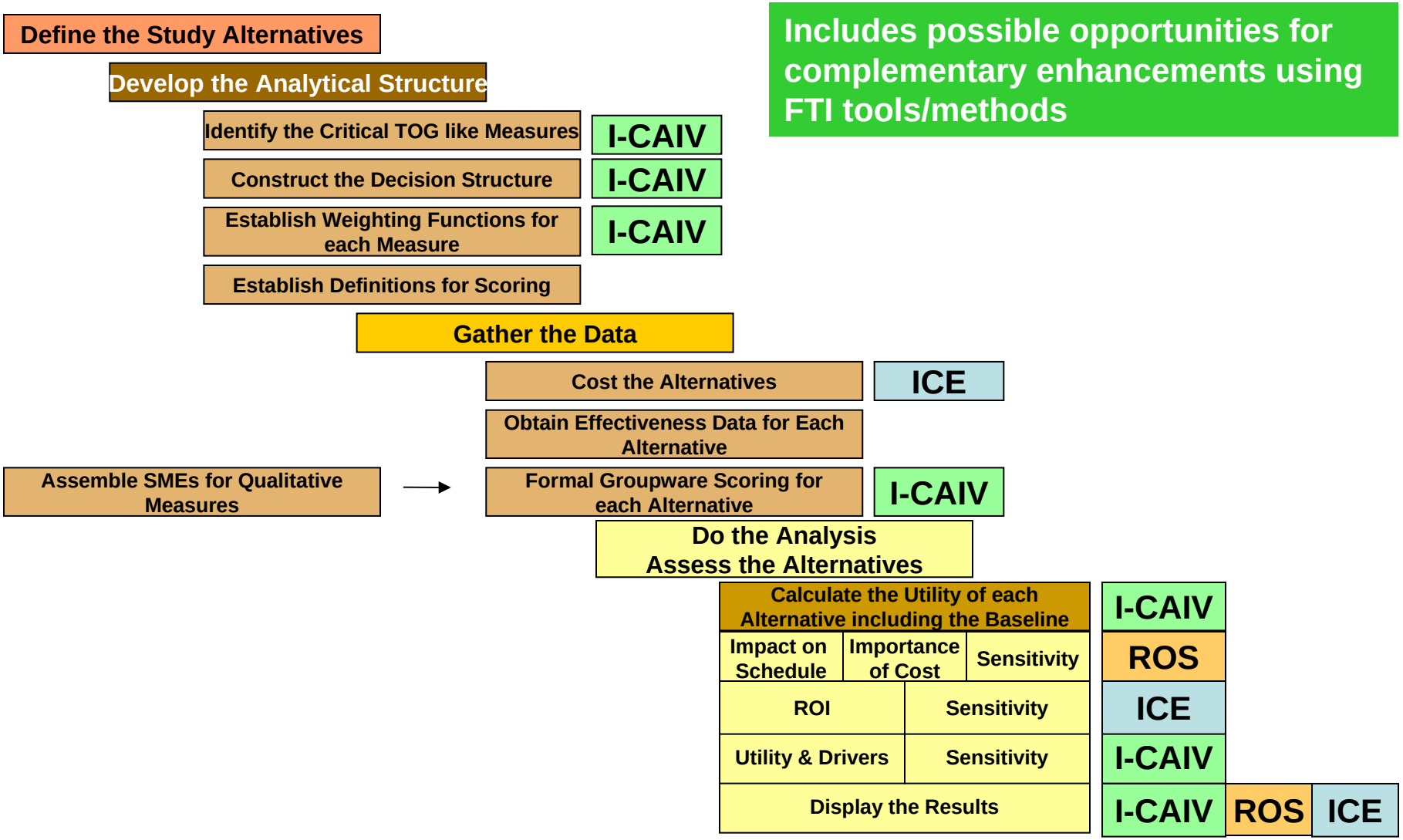
Investment/System Portfolio Optimization



FTI

MDA Investment Analysis Process

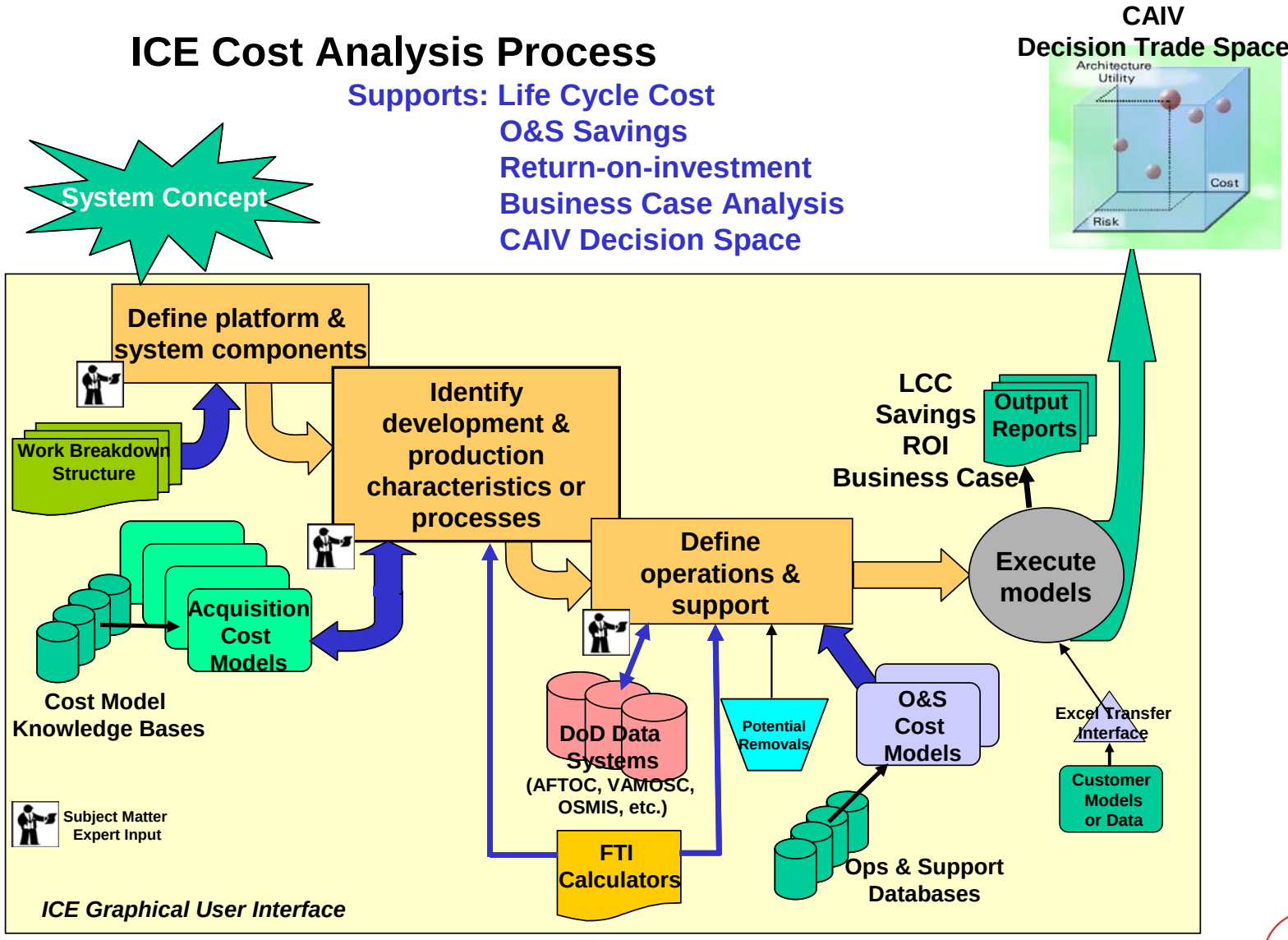
Includes possible opportunities for complementary enhancements using FTI tools/methods



Complementary interface with FTI Tools

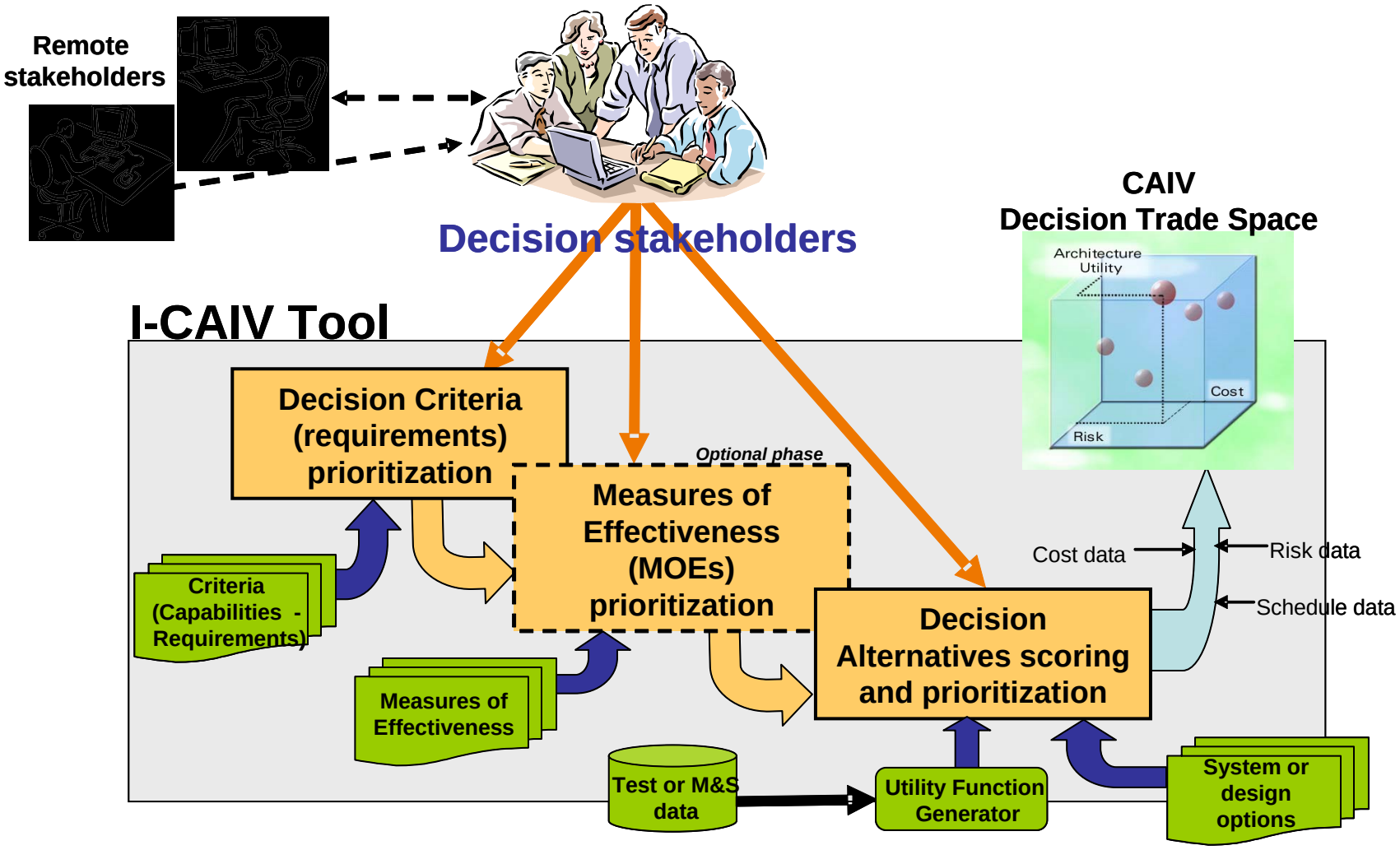
ICE Cost Analysis Process

Existing FTI Analysis Tools



I-CAIV Tool and Evaluation Process

Existing FTI Analysis Tools



CAIV Decision Trade Space Inputs

Alternative Performance Assessments

(MDA / DE and/or the Elements)

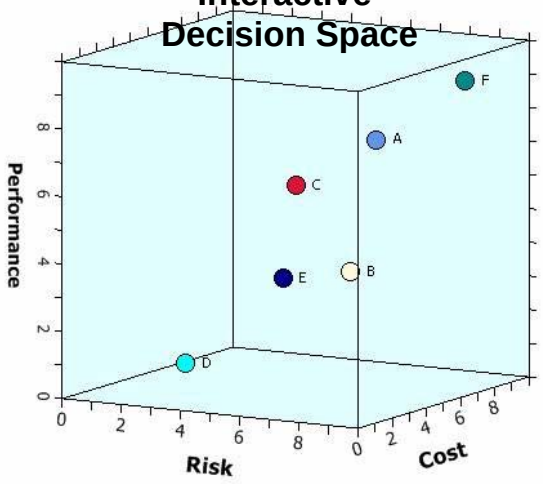
I-CAIV

MDA / DE, DO & the Elements

Benefit

Cost

MDA Interactive Decision Space



Alternative Cost Estimates

(MDA / DOBE and/or the Elements)

ICE™

MDA / DO & DE

Alternative Risk Assessments

(MDA / DE)

Risk

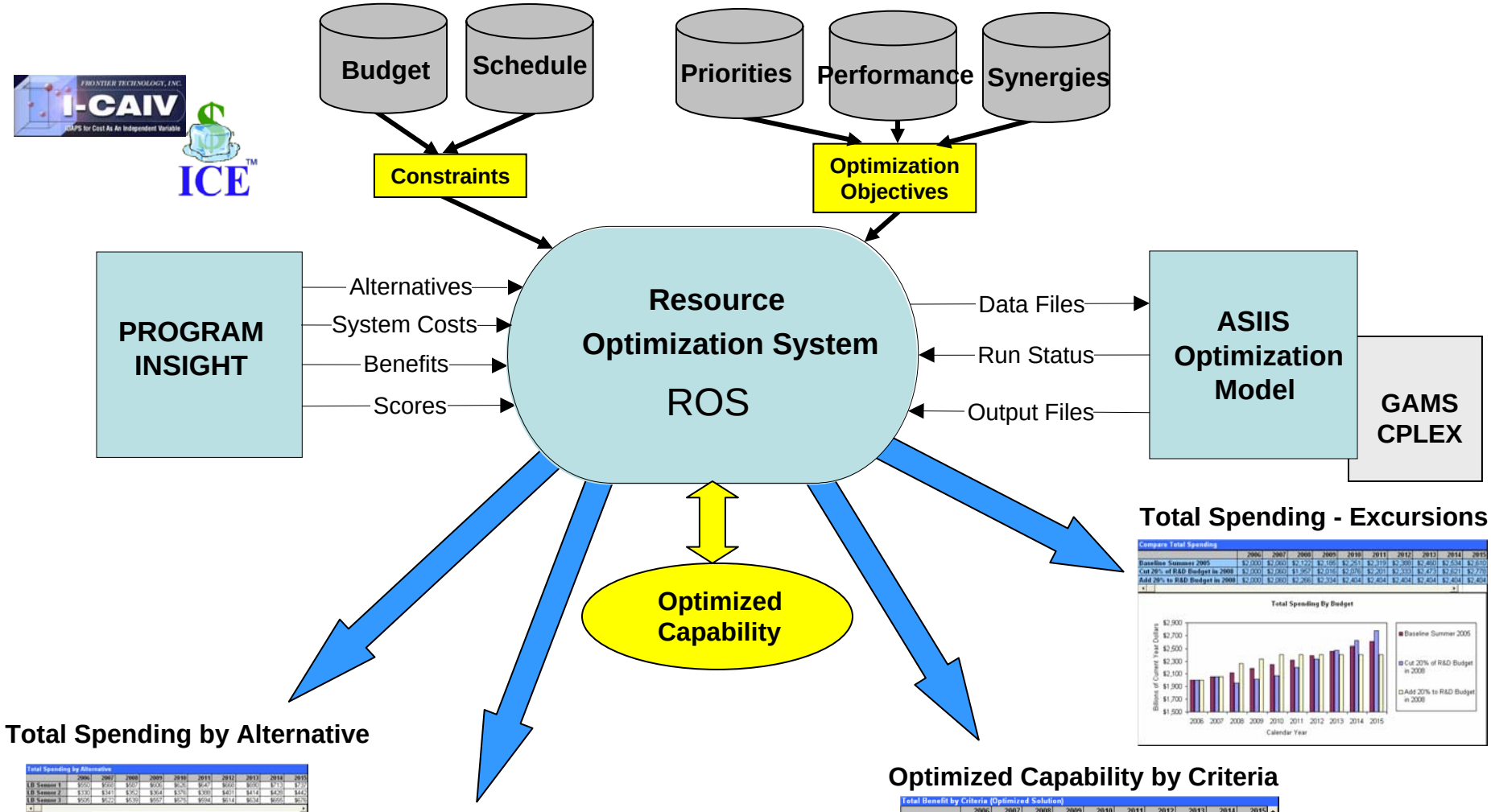
Schedule

Alternative Schedule Assessments

(MDA / DO)

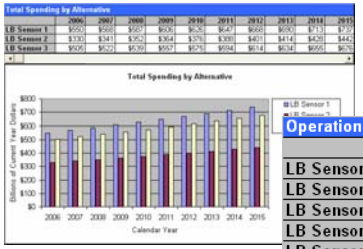
FTI

Resource Optimization System

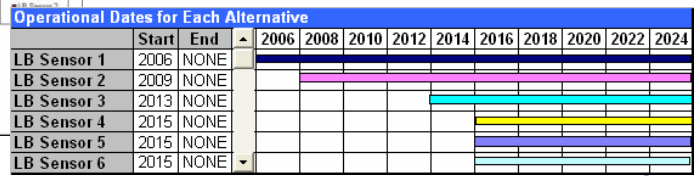


Total Spending - Excursions

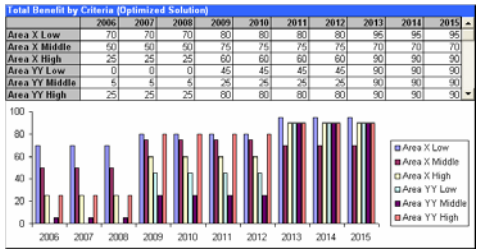
Total Spending by Alternative



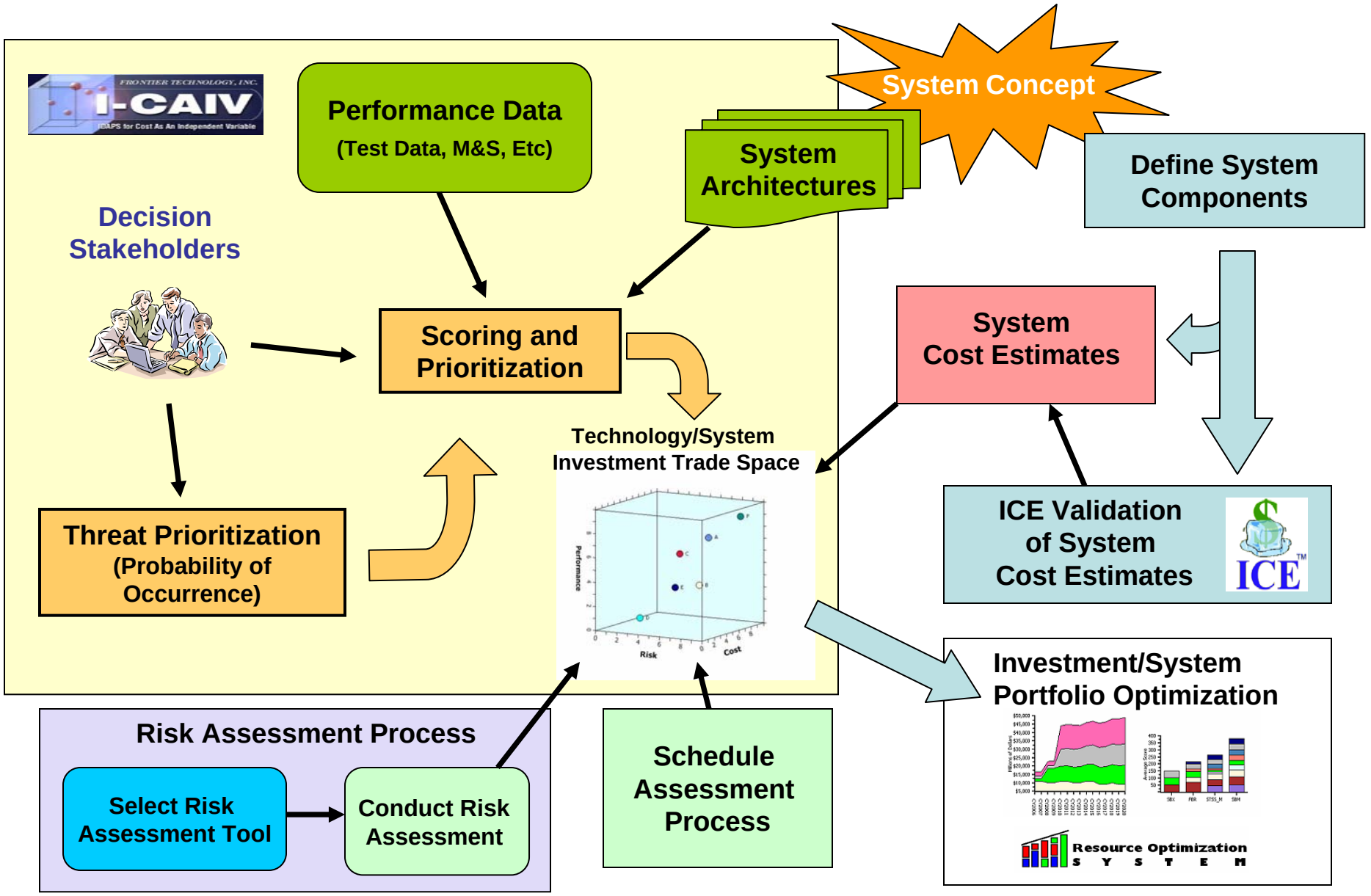
Schedule for Expenditures



Optimized Capability by Criteria

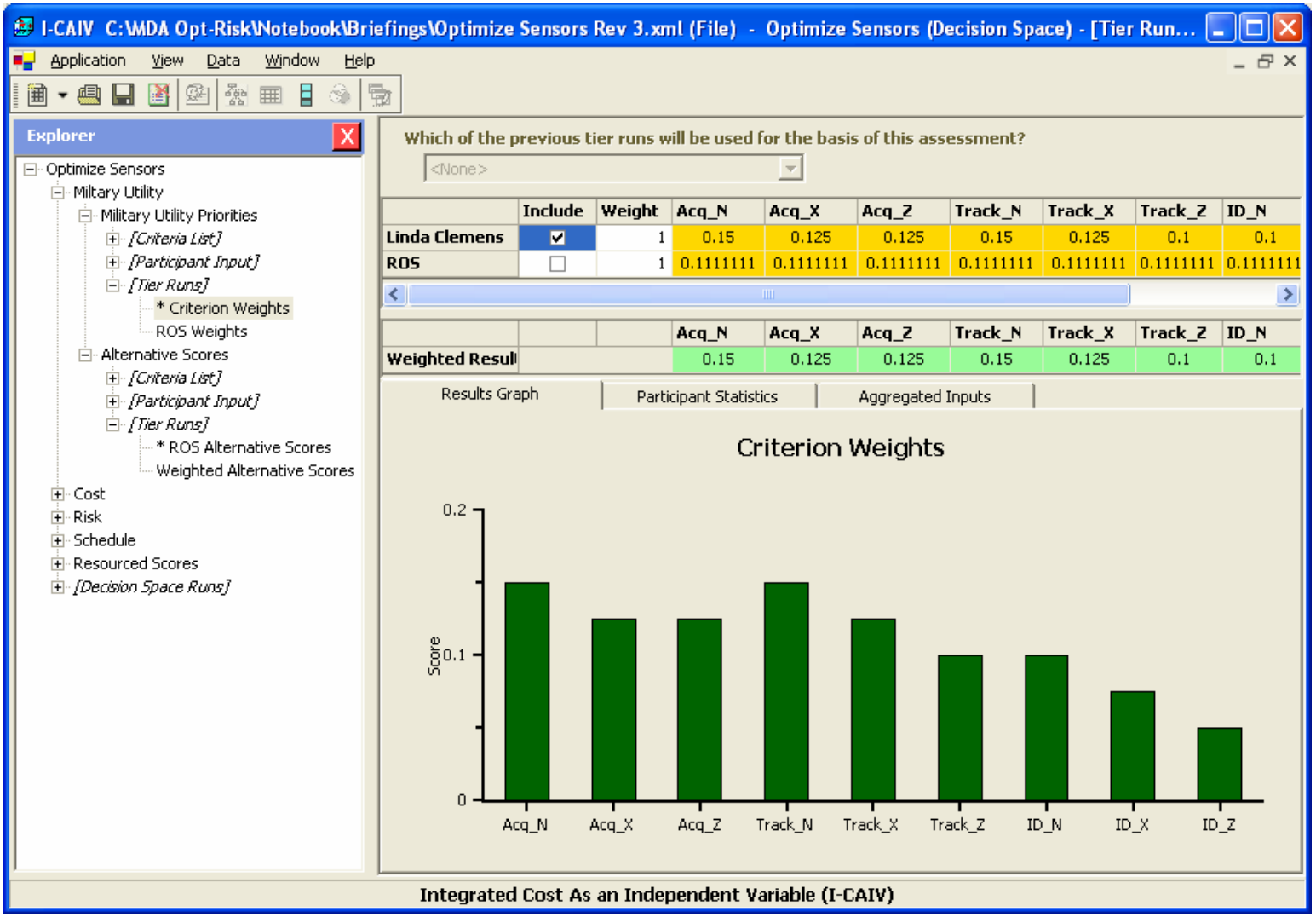


Refined "Investment Analysis" Process



Criterion Weights for ROS

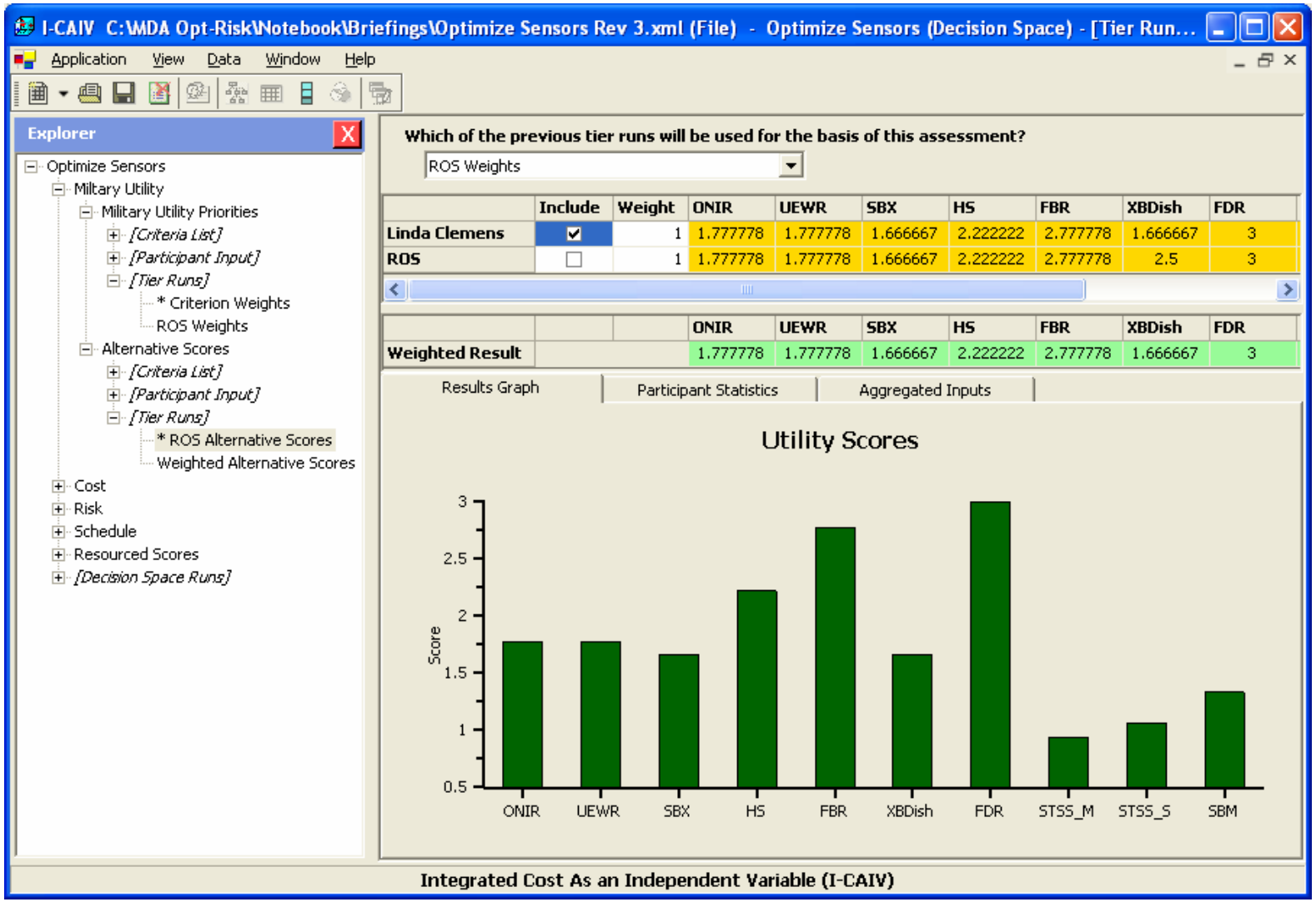
(Input from I-CAIV)



Notional Data

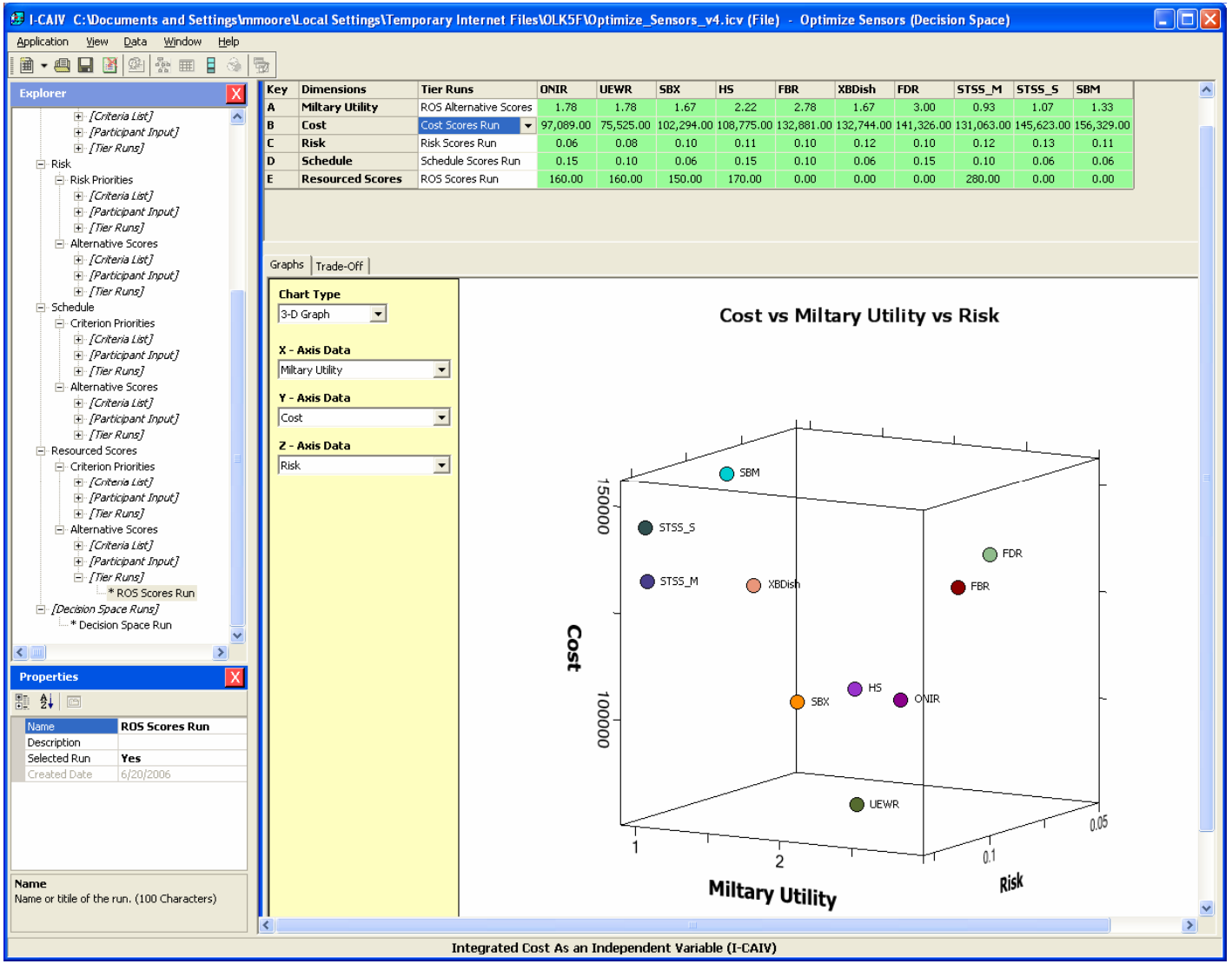
Utility Scores for ROS

(Input from I-CAIV)



Notional Data

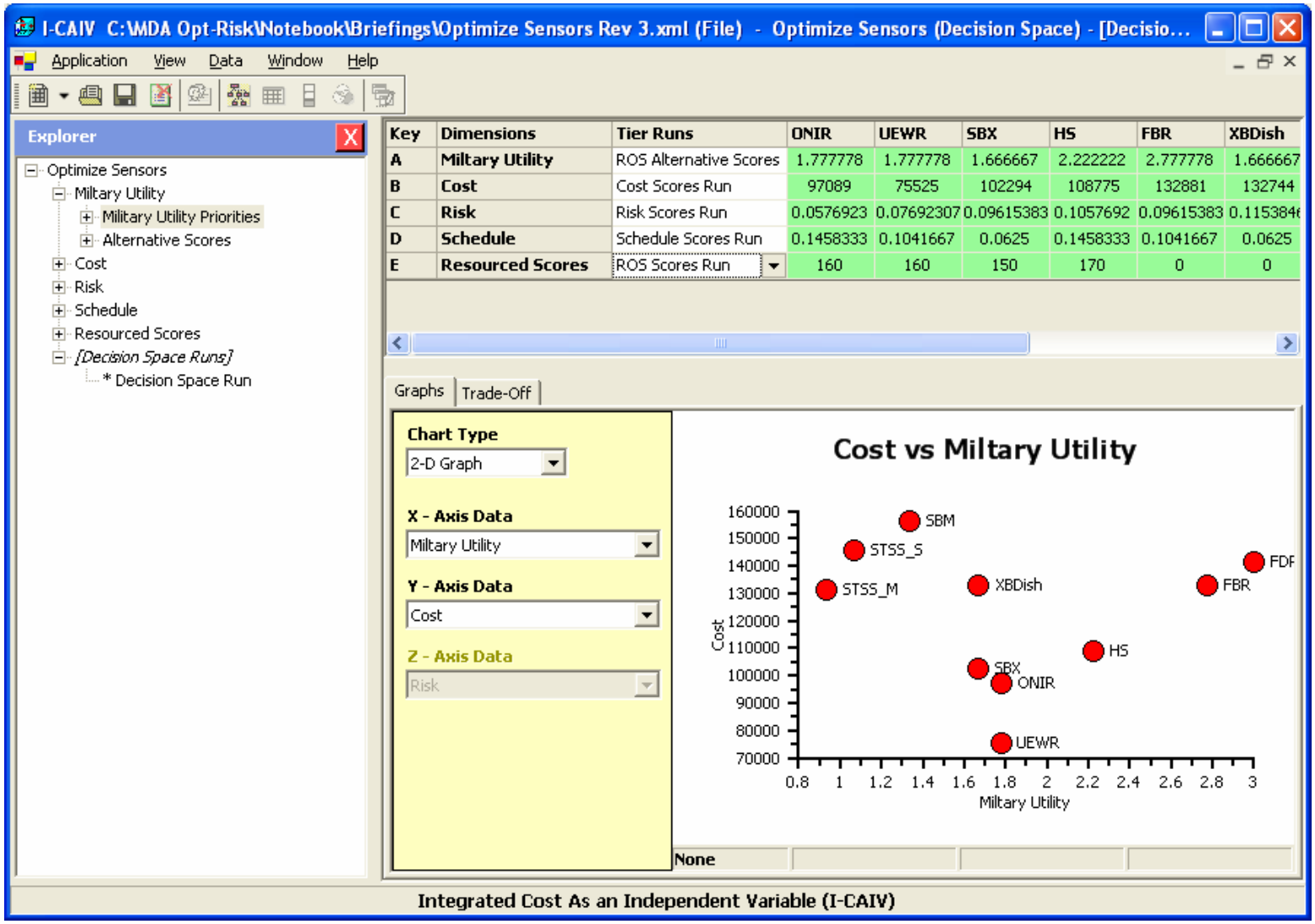
Summary I-CAIV Results for ROS



Key	Dimensions	Tier Runs	ONIR	UEWR	SBX	HS	FBR	XBDish	FDR	STSS_M	STSS_S	SBM
A	Miltary Utility	ROS Alternative Scores	1.78	1.78	1.67	2.22	2.78	1.67	3.00	0.93	1.07	1.33
B	Cost	Cost Scores Run	97,089.00	75,525.00	102,294.00	108,775.00	132,881.00	132,744.00	141,326.00	131,063.00	145,623.00	156,329.00
C	Risk	Risk Scores Run	0.06	0.08	0.10	0.11	0.10	0.12	0.10	0.12	0.13	0.11
D	Schedule	Schedule Scores Run	0.15	0.10	0.06	0.15	0.10	0.06	0.15	0.10	0.06	0.06
E	Resourced Scores	ROS Scores Run	160.00	160.00	150.00	170.00	0.00	0.00	0.00	280.00	0.00	0.00

Notional Data

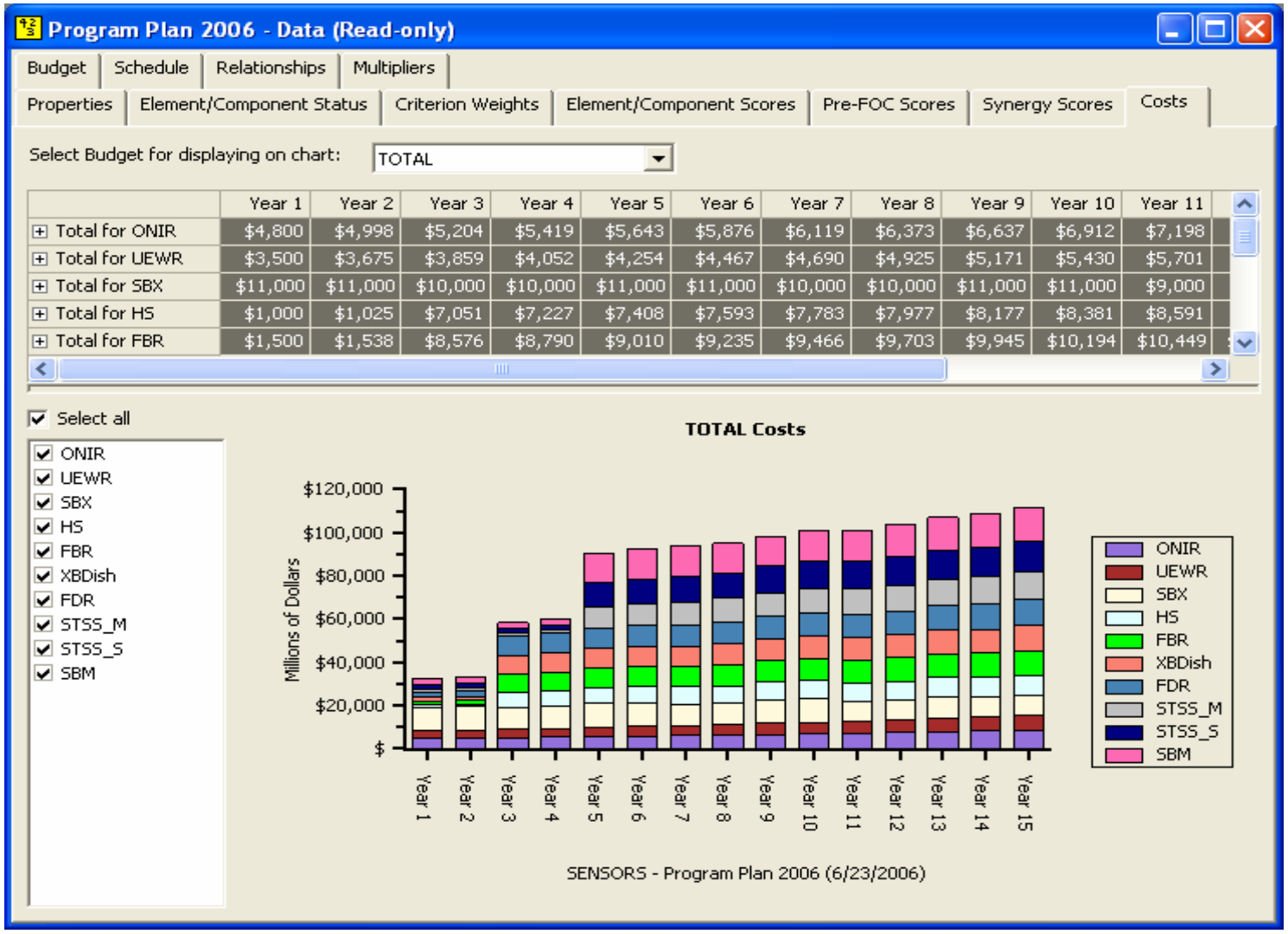
Summary I-CAIV Results for ROS



Key	Dimensions	Tier Runs	ONIR	UEWR	SBX	HS	FBR	XBDish
A	Miltary Utility	ROS Alternative Scores	1.777778	1.777778	1.666667	2.222222	2.777778	1.666667
B	Cost	Cost Scores Run	97089	75525	102294	108775	132881	132744
C	Risk	Risk Scores Run	0.0576923	0.07692307	0.09615383	0.1057692	0.09615383	0.1153846
D	Schedule	Schedule Scores Run	0.1458333	0.1041667	0.0625	0.1458333	0.1041667	0.0625
E	Resourced Scores	ROS Scores Run	160	160	150	170	0	0

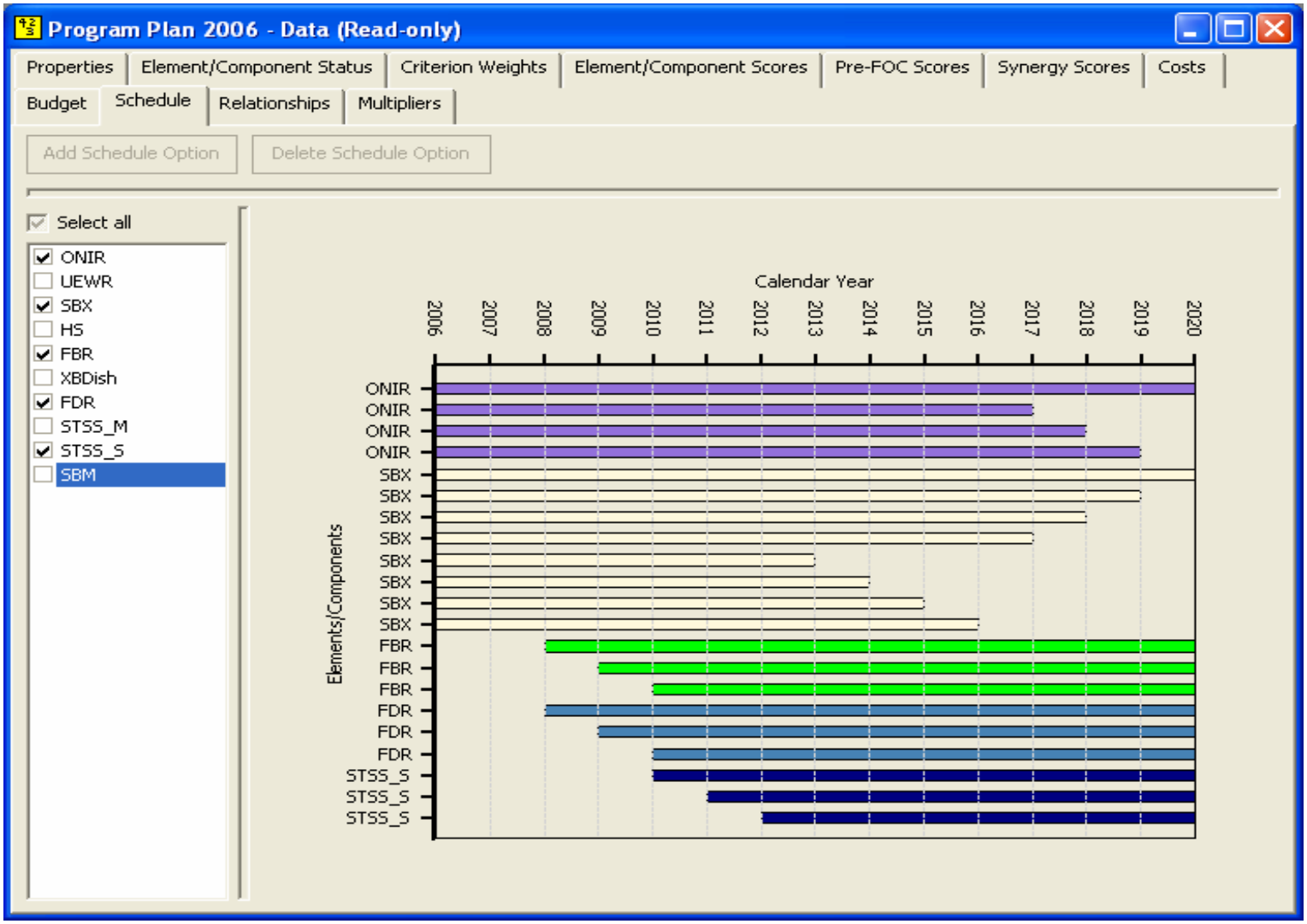
Notional Data

Input Data for ROS - Total System Costs



Notional Data

Input Data for ROS – Schedule for each System



Notional Data

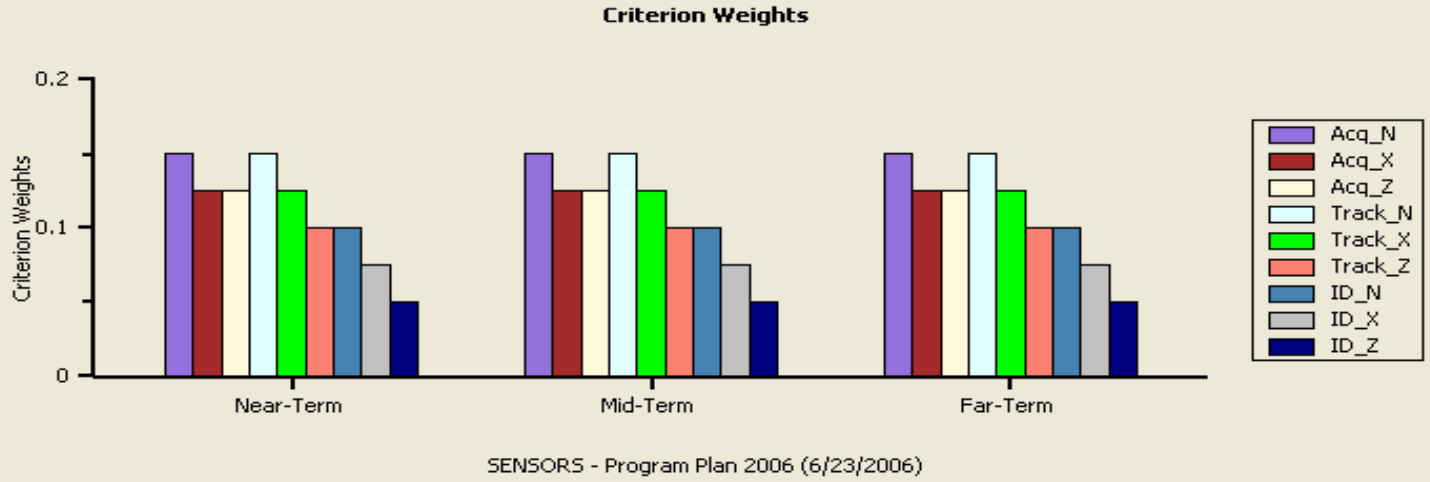
ROS Inputs - Criterion Weights

Program Plan 2006 - Data (Read-only)

Budget | Schedule | Relationships | Multipliers

Properties | Element/Component Status | Criterion Weights | Element/Component Scores | Pre-FOC Scores | Synergy Scores | Costs

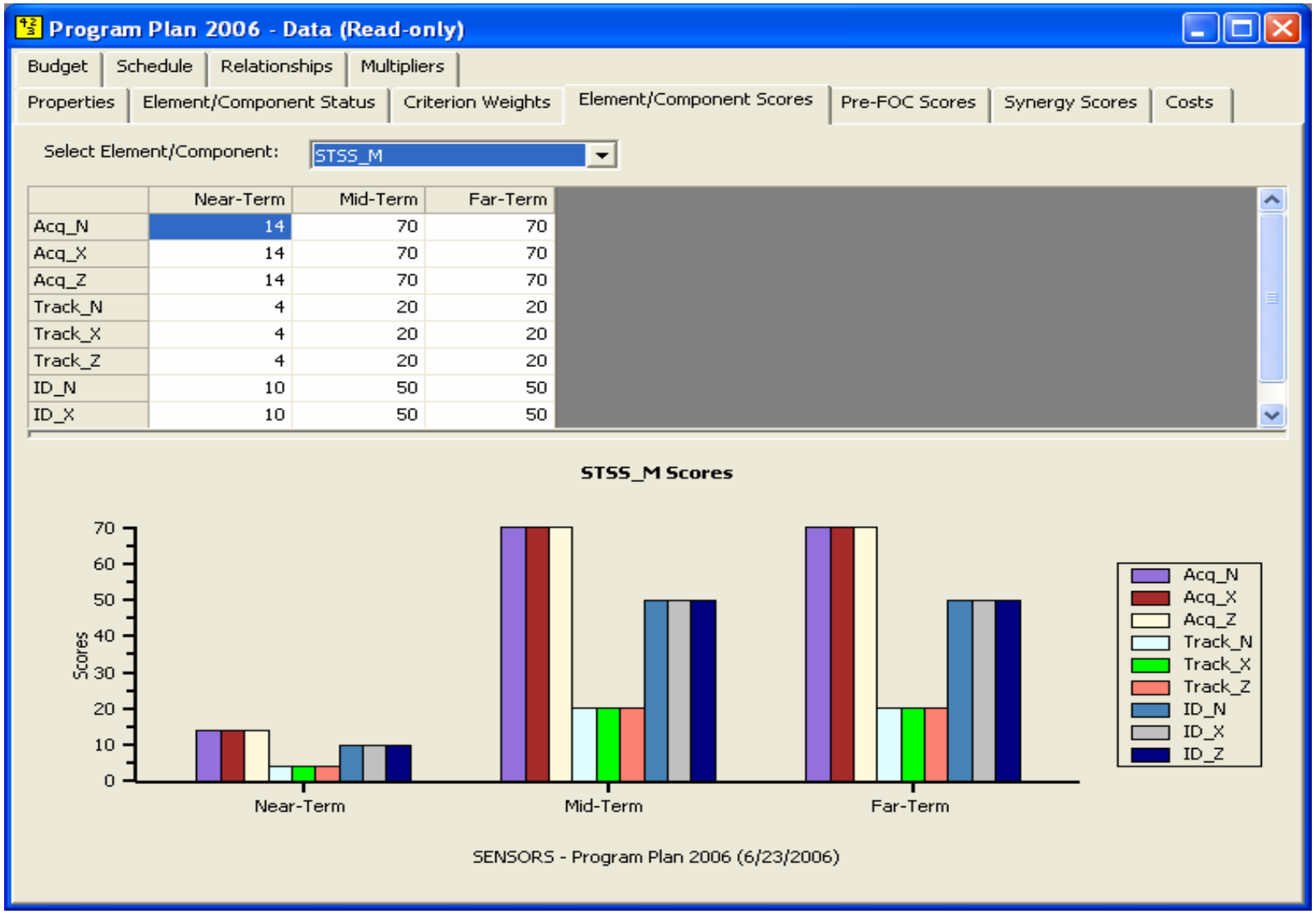
Criterion	Near-Term	Mid-Term	Far-Term
Acq_N	.1500	.1500	.1500
Acq_X	.1250	.1250	.1250
Acq_Z	.1250	.1250	.1250
Track_N	.1500	.1500	.1500
Track_X	.1250	.1250	.1250
Track_Z	.1000	.1000	.1000
ID_N	.1000	.1000	.1000
ID_X	.0750	.0750	.0750
ID_Z	.0500	.0500	.0500
TOTAL	1.0000	1.0000	1.0000



SENSORS - Program Plan 2006 (6/23/2006)

Notional Data

ROS Input - Element / Component Scores



	Near-Term	Mid-Term	Far-Term
Acq_N	14	70	70
Acq_X	14	70	70
Acq_Z	14	70	70
Track_N	4	20	20
Track_X	4	20	20
Track_Z	4	20	20
ID_N	10	50	50
ID_X	10	50	50

Notional Data

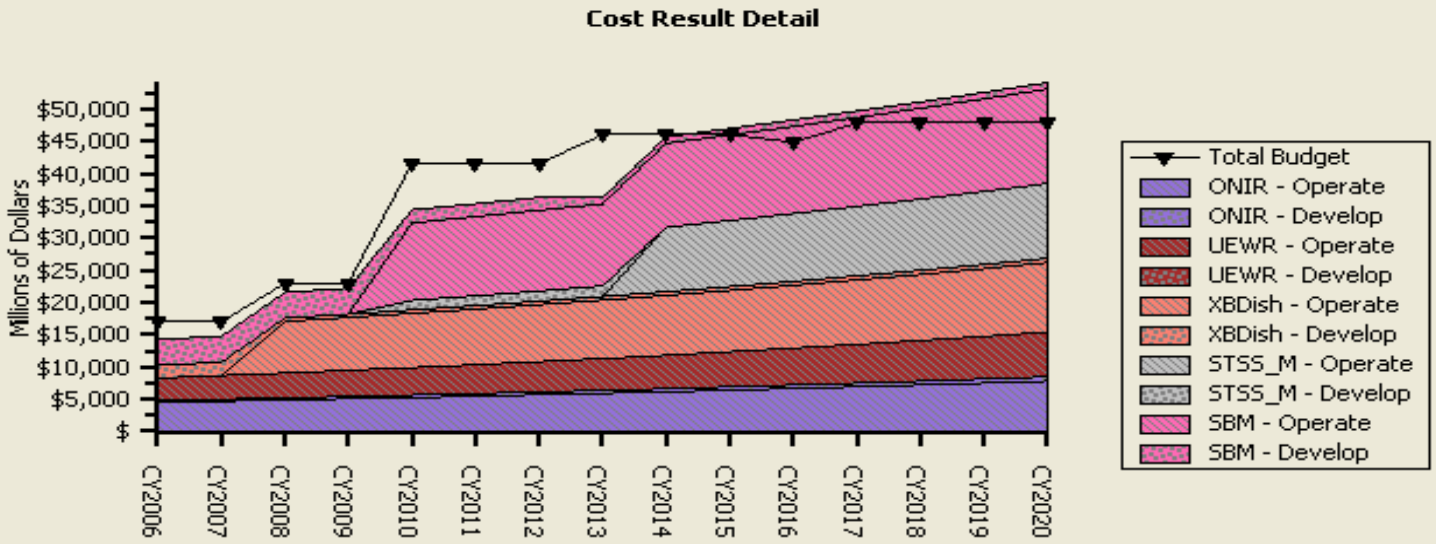
Optimization Output - Cost Result Detail

Accelerate STSS - Results

Schedule | Spending | Criteria

Spending Detail | Rollup by Element/Component | Rollup by Budget

	CY2006	CY2007	CY2008	CY2009	CY2010	CY2011	CY2012	CY2013	CY2014	CY2015	CY20
Total for ONIR	$4,800	$4,998	$5,204	$5,419	$5,643	$5,876	$6,120	$6,373	$6,637	$6,912	$7,1
Total for UEWR	$3,500	$3,675	$3,859	$4,052	$4,254	$4,467	$4,690	$4,925	$5,171	$5,430	$5,7
Total for XBDish	$2,000	$2,050	$8,500	$8,713	$8,930	$9,153	$9,383	$9,617	$9,858	$10,103	$10,1
Total for STSS_M	$	$	$	$	$1,500	$1,538	$1,576	$1,615	$10,000	$10,250	$10,5
Total for SBM	$4,000	$4,000	$4,000	$4,000	$14,000	$14,240	$14,485	$13,734	$13,989	$14,249	$14,5



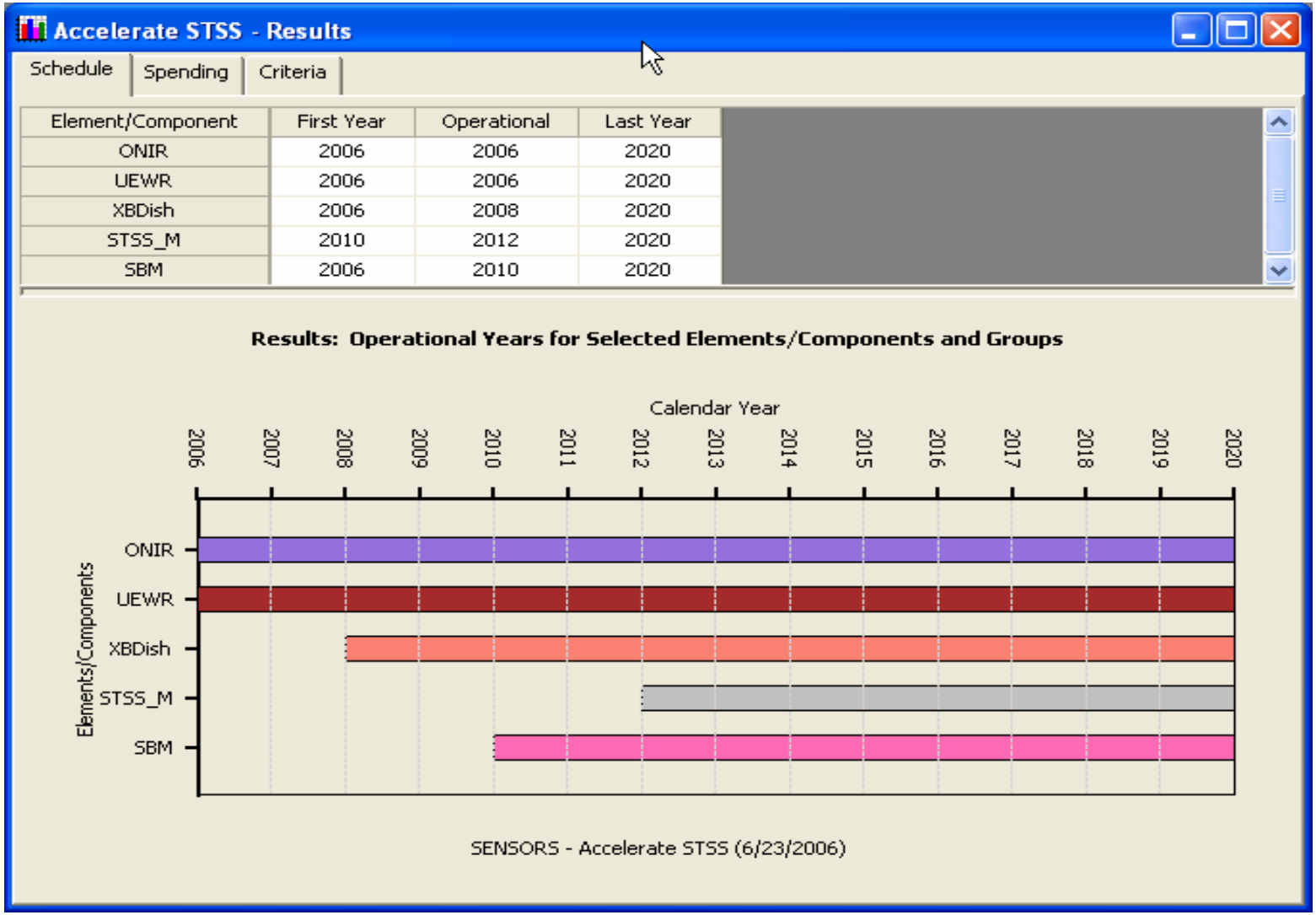
Notional Data

Optimization Output - Schedule Results

Accelerate STSS - Results

Schedule | Spending | Criteria

Element/Component	First Year	Operational	Last Year
ONIR	2006	2006	2020
UEWR	2006	2006	2020
XBDish	2006	2008	2020
STSS_M	2010	2012	2020
SBM	2006	2010	2020



Notional Data

Optimization Output - Performance Results

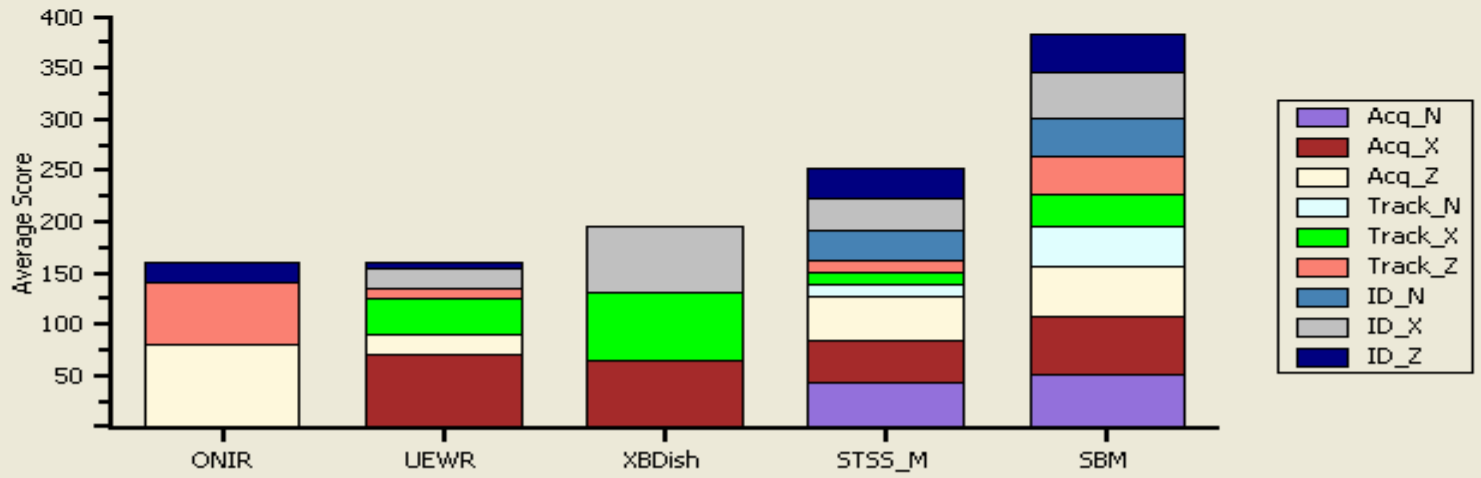
Accelerate STSS - Results

Schedule | Spending | Criteria

Select Type of Display: Average Rollup by Element/Component

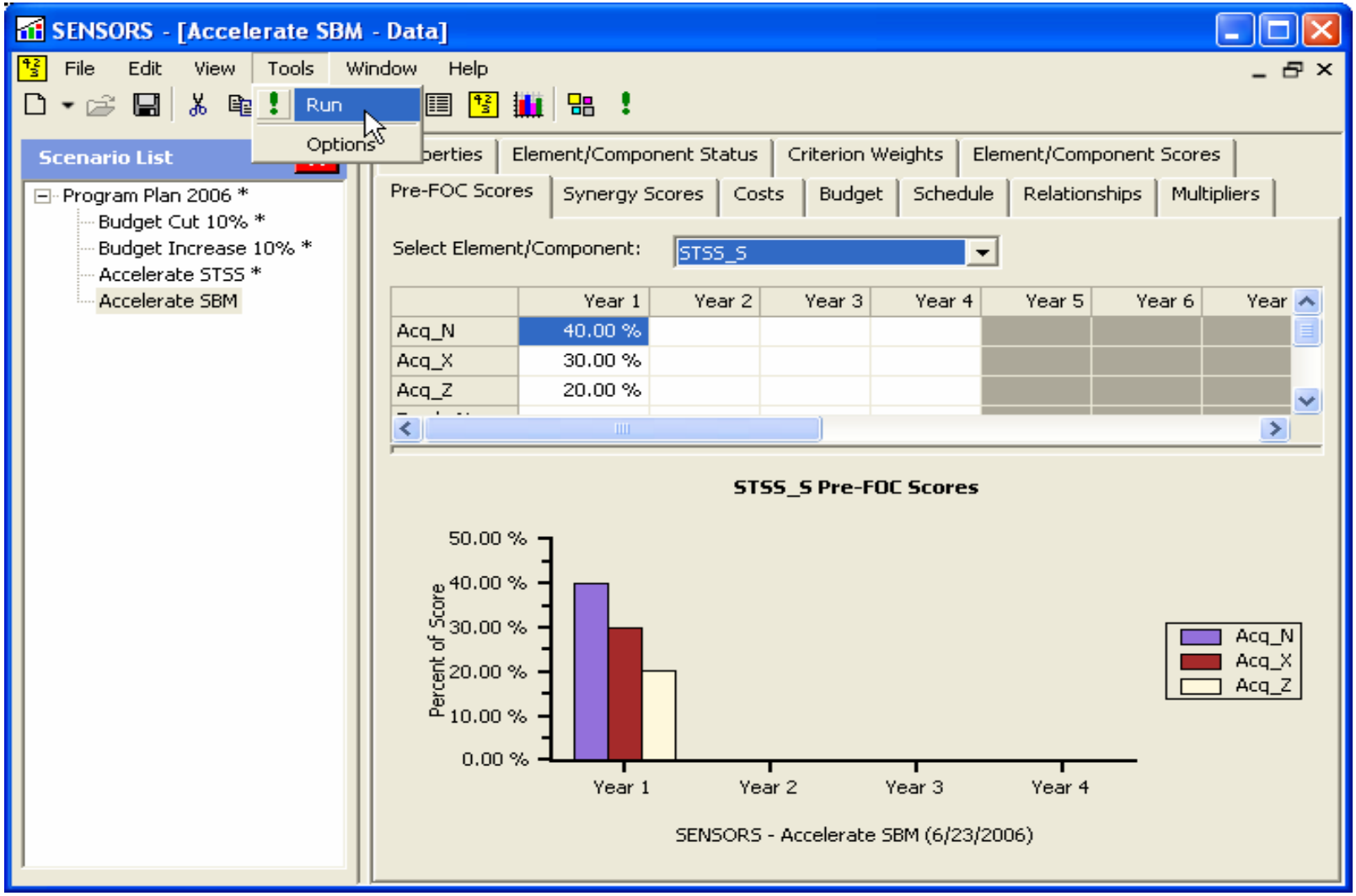
	CY2006	CY2007	CY2008	CY2009	CY2010	CY2011	CY2012	CY2013	CY2014	CY2015	CY20
Total for ONIR	160	160	160	160	160	160	160	160	160	160	1
Total for UEWR	160	160	160	160	160	160	160	160	160	160	1
Total for XBDish	0	0	225	225	225	225	225	225	225	225	2
Total for STSS_M	0	0	0	0	0	0	420	420	420	420	4

Results: Average Criterion for Each Element/Component



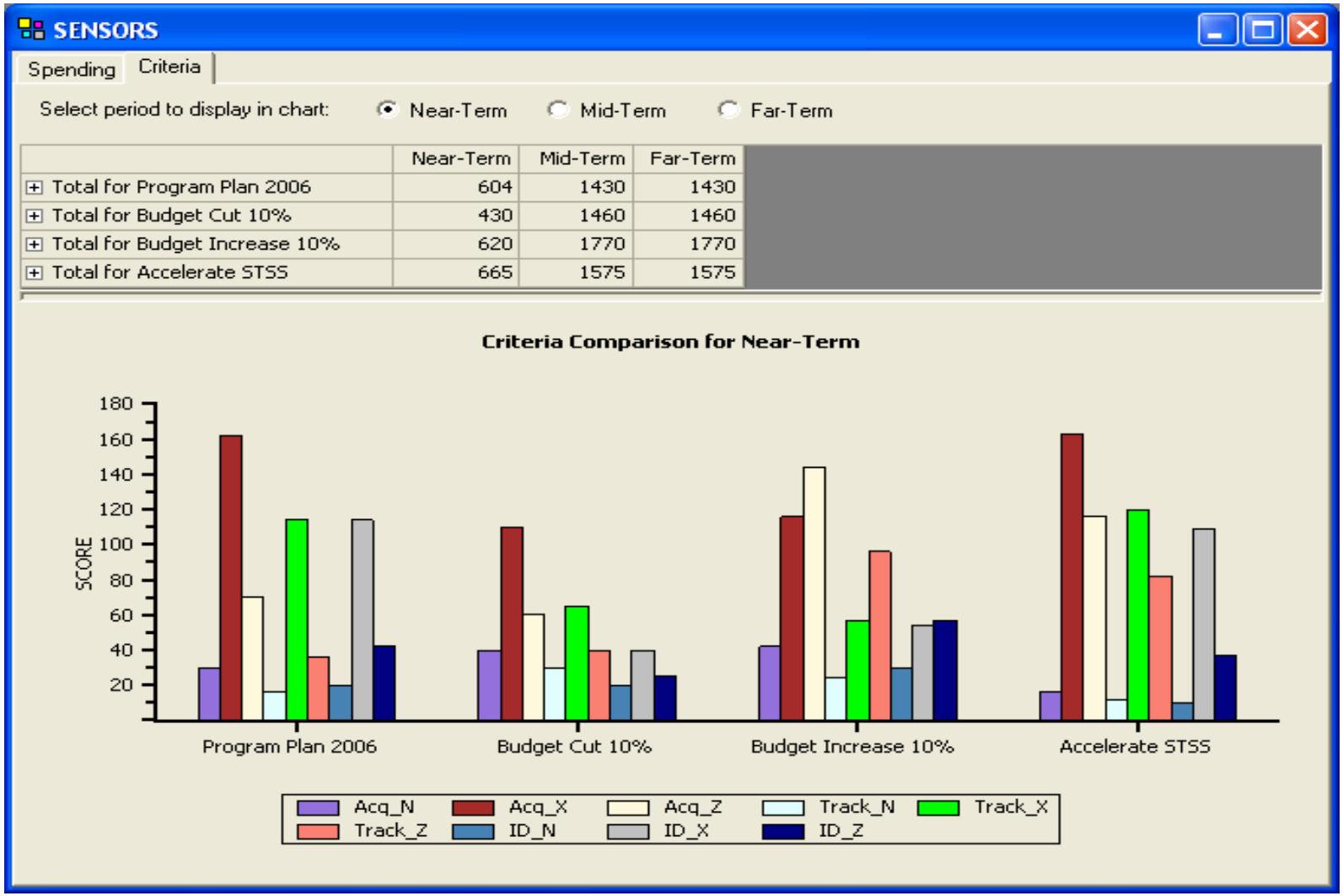
Notional Data

Optimization Sensitivity



Notional Data

Sensitivity Results



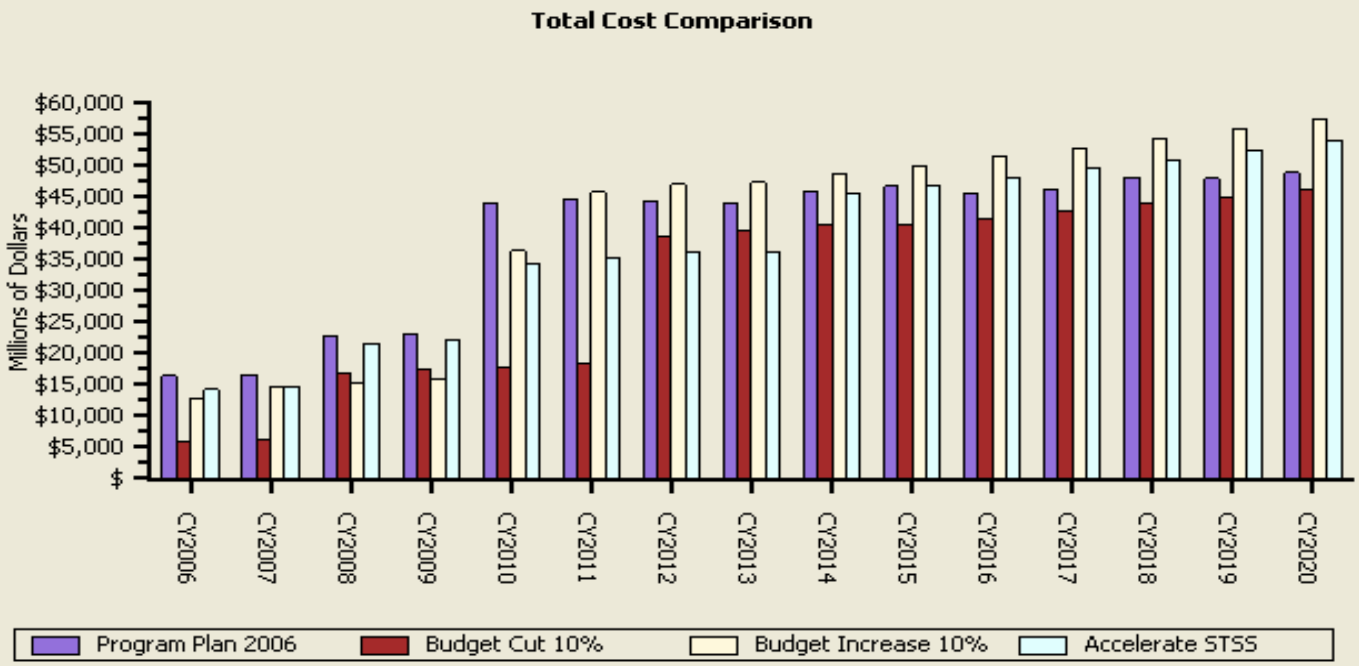
Notional Data

Total Cost Comparison

SENSORS

Spending | Criteria

	CY2006	CY2007	CY2008	CY2009	CY2010	CY2011	CY2012	CY2013	CY2014
⊞ Total for Program Plan 2006	$16,500	$16,626	$22,753	$23,058	$44,010	$44,725	$44,458	$44,206	$45,973
⊞ Total for Budget Cut 10%	$6,000	$6,238	$16,859	$17,365	$17,887	$18,427	$38,624	$39,598	$40,599
⊞ Total for Budget Increase 10%	$12,800	$14,773	$15,303	$15,854	$36,512	$45,858	$47,102	$47,384	$48,708
⊞ Total for Accelerate STSS	$14,300	$14,723	$21,563	$22,184	$34,327	$35,274	$36,254	$36,264	$45,655



Notional Data

Summary

- **Robust Investment Analysis capability including optimization now available for MDA use**
- **Methodology successfully used in internal studies as a "proof-of-concept"**
- **ROS**
  - **Uses a proven military model for capital investments and force planning**
  - **Powerful interface for easy data entry and management, and flexible reports**
  - **Evaluates task priorities, system capability, costs, and schedule parameters**
- **Methodology and Toolset help provide strong "Program Justification"**

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