

Life Cycle Assessment

Tools for Sustainability:

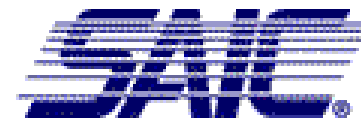
Impact Analysis & Integrated Technology Assessment Tools

Environmental Protection Agency

International Conference on Life Cycle Assessment

25-27 Apr 2000

Bill Custer, SAIC
custerw@saic.com



Science Applications International Corporation
An Employee-Owned Company

Background on Impact Analysis

- US Navy is testing 35 new materials and processes
 - meet regulatory compliance and pollution prevention goals
 - need to choose which ones to implement
- Independent Life Cycle Assessment - environmental & economic
- Limited funds constrained LCA phases:
 - install, operations, maintenance, and disposal



Impact Analysis Measures of Merit

- Environmental Impacts
 - Hazardous Material and Waste Reductions
 - Regulated Hazardous Chemical Reductions
 - Toxic Release Inventory
 - Other Lists: HAP, VOC, Carcinogens, etc.
- Life Cycle Cost Analysis
 - Compare Technology Alternatives
 - Net Present Value, Payback, ROI , and more


















Ground Rules

- Apply OMB Circular A-11 and A-94
 - Planning, Budgeting, and Acquisition...
 - Guidelines for Benefit-Cost Analysis...
- Life Cycle Analysis Requirements:
 - Enterprise-wide Analysis
 - Site-variable Cost Drivers
 - Sound Engineering Assumptions
 - Apply consistent Default Cost Factors
 - Show Cash Flows
 - Highlight Toxic Chemical Reductions

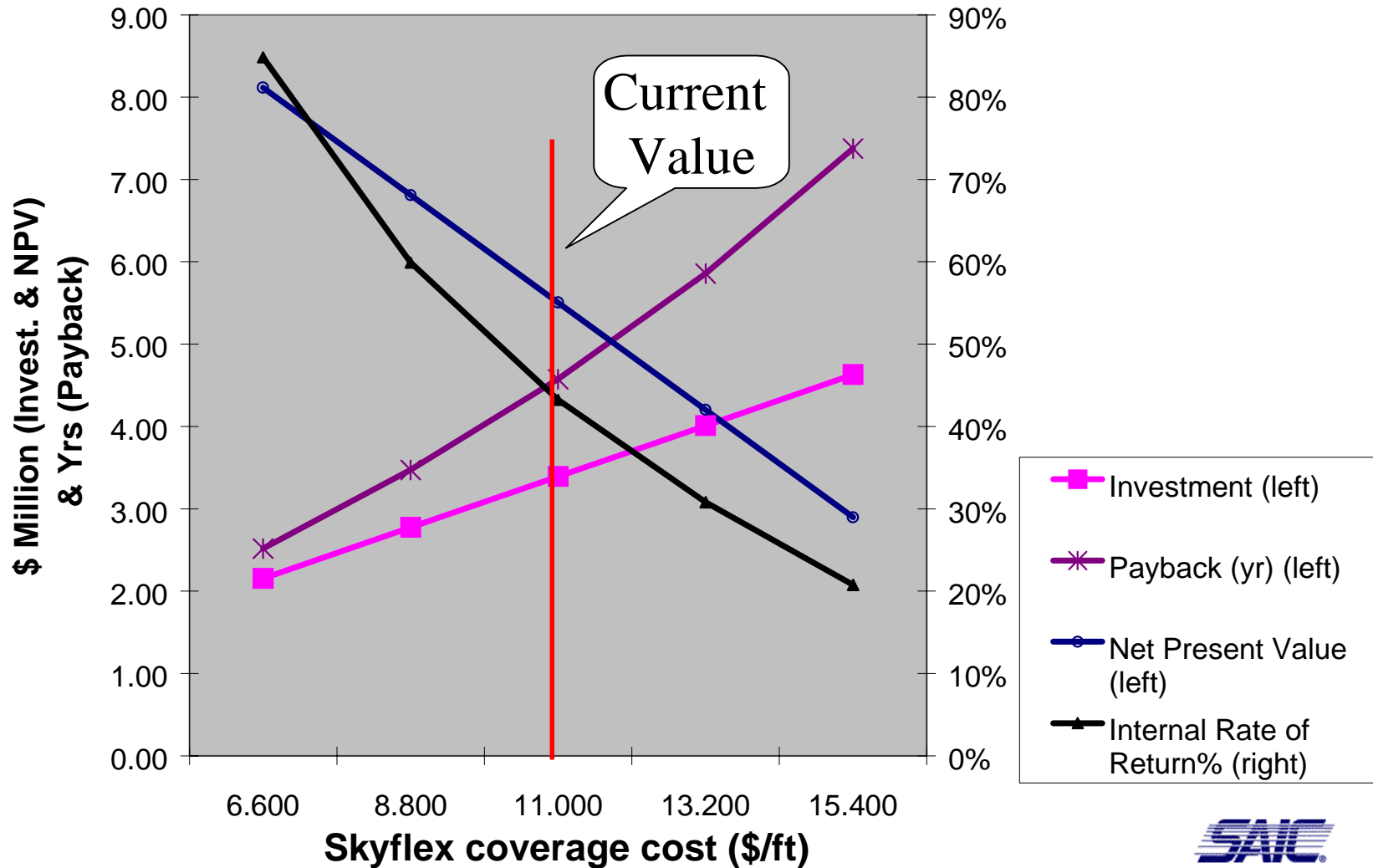
Site Cost Drivers: workload, rates, and local constraints

<i>Skyflex vs. chromated sealants</i>		Inputs
Start Year:	1999	
Site:	Summary	Baseline
<i>Site Cost Drivers</i>	All sites	Fort X
Aircraft Inventory	3,727	56
Linear feet panels sealed	193,605	11,041
Labor Rate	\$25.15	\$51.43
# Sites	66	1
% Technology Replacement	81.6%	90%
Chromium Control ? (yes=1,no=0)	0	0
Waste Disposal Cost (\$/lb)	\$1.36	\$1.32

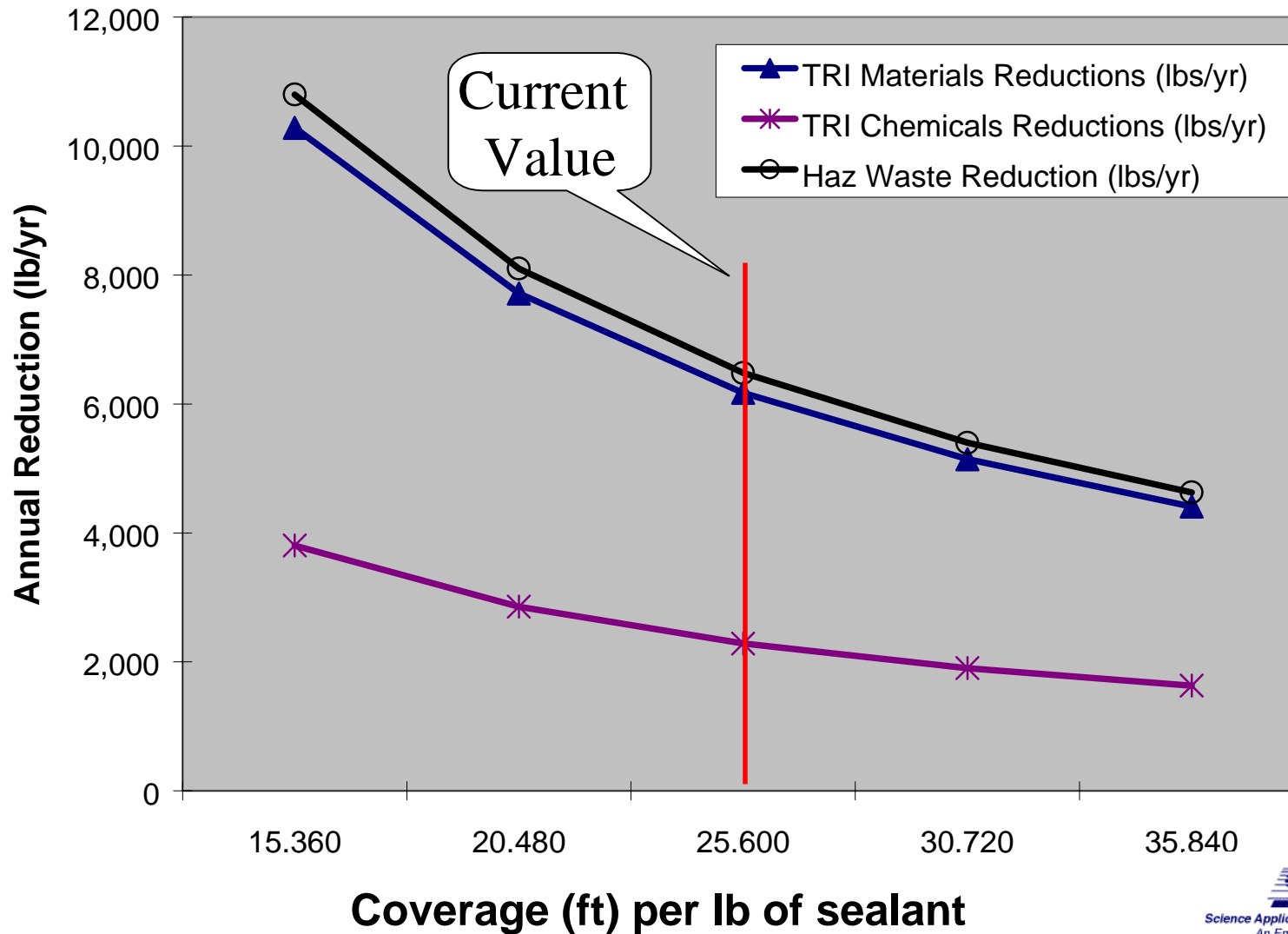
Sensitivity Analysis: Evaluate Engineering and Cost Parameter Variations

Parameter	Value	Data Source				
Unit cost for polysulfide sealant (\$/lb)	\$45.71	NAWC PAX	based on reported \$16.00 cost for 6 oz cartridge			
Coverage (ft) per lb of sealant	25.6	NAWC PAX	based on 10 feet for 6 oz cartridge			
Estimated number of reapplications of polysulfide	3		assumption based on polysulfide sealant useage in skyflex report for E-6 and SH-60			
Coverage per foot of skyflex (ft)	1	NAWC PAX				
Skyflex coverage cost (\$/ft)	\$11.00	NAWC PAX				
Weight of skyflex (lbs/ft)	0.012		Based on measured weight of .2 oz/ft			
		Skyflex	Derived from labor hours needed to apply cartridges for SH-60 and E-6 aircraft			

Economic Metrics

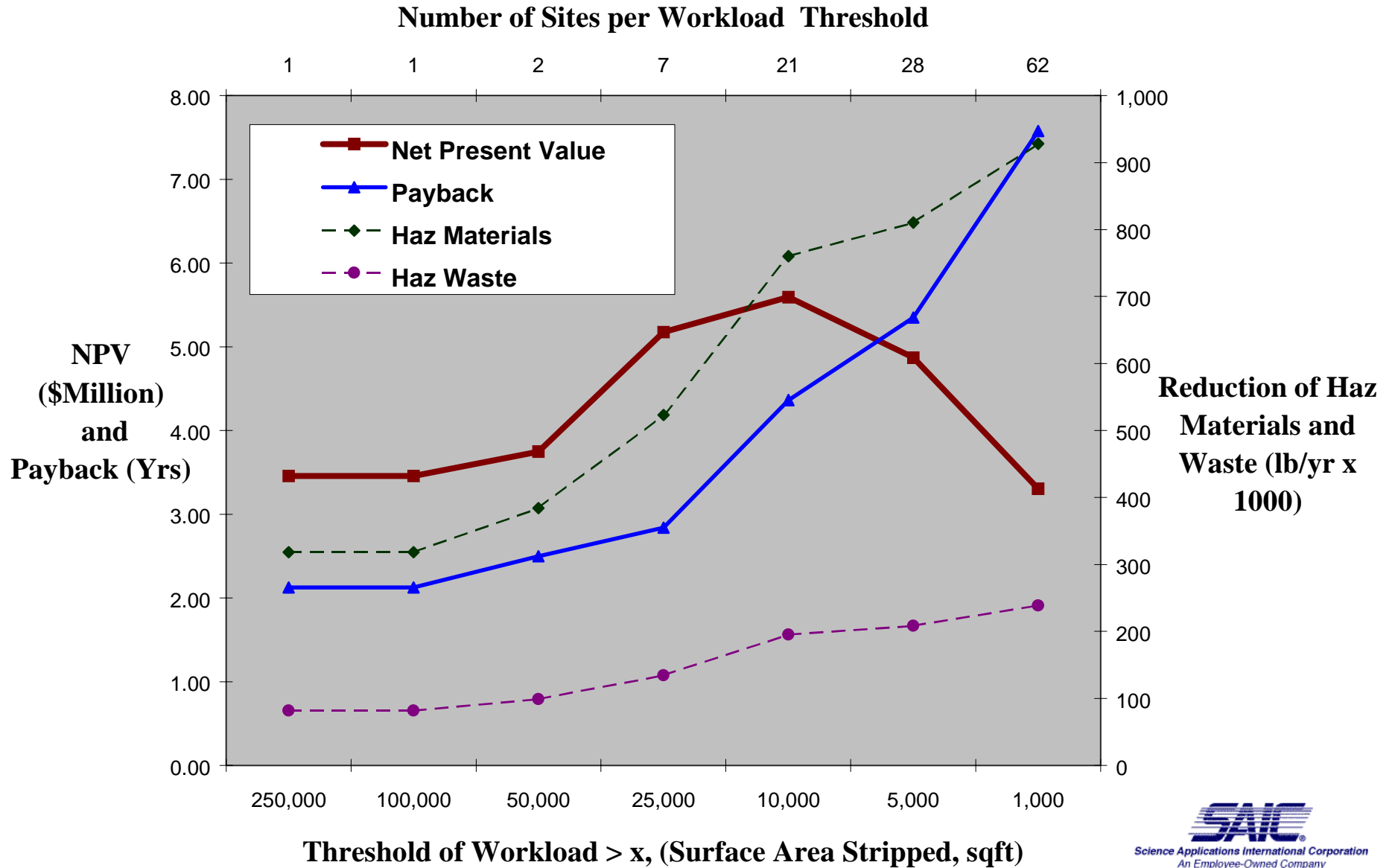


Environmental Metrics

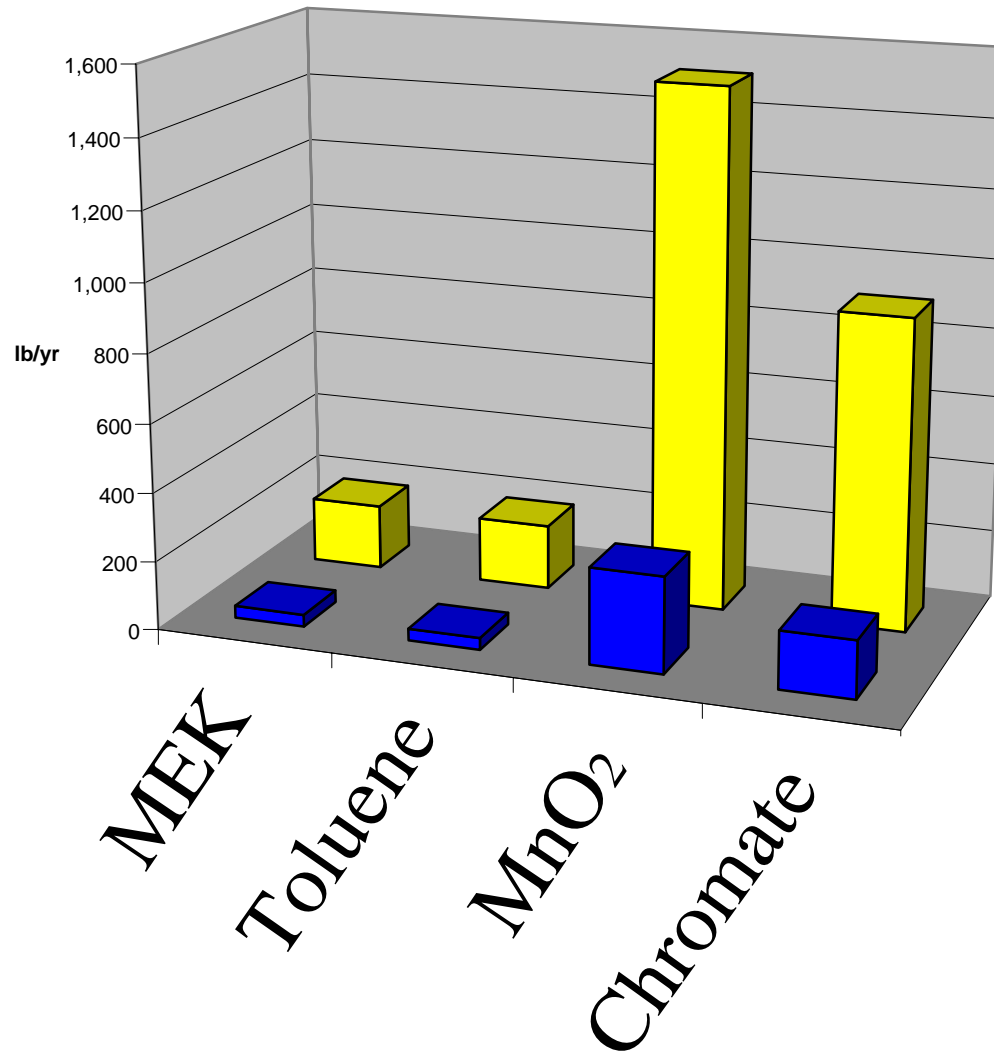


Sensitivity Analysis: Multiple Site Deployment

Non-HAP Chemical Paint Stripper



Toxic Chemical Reductions Graphs

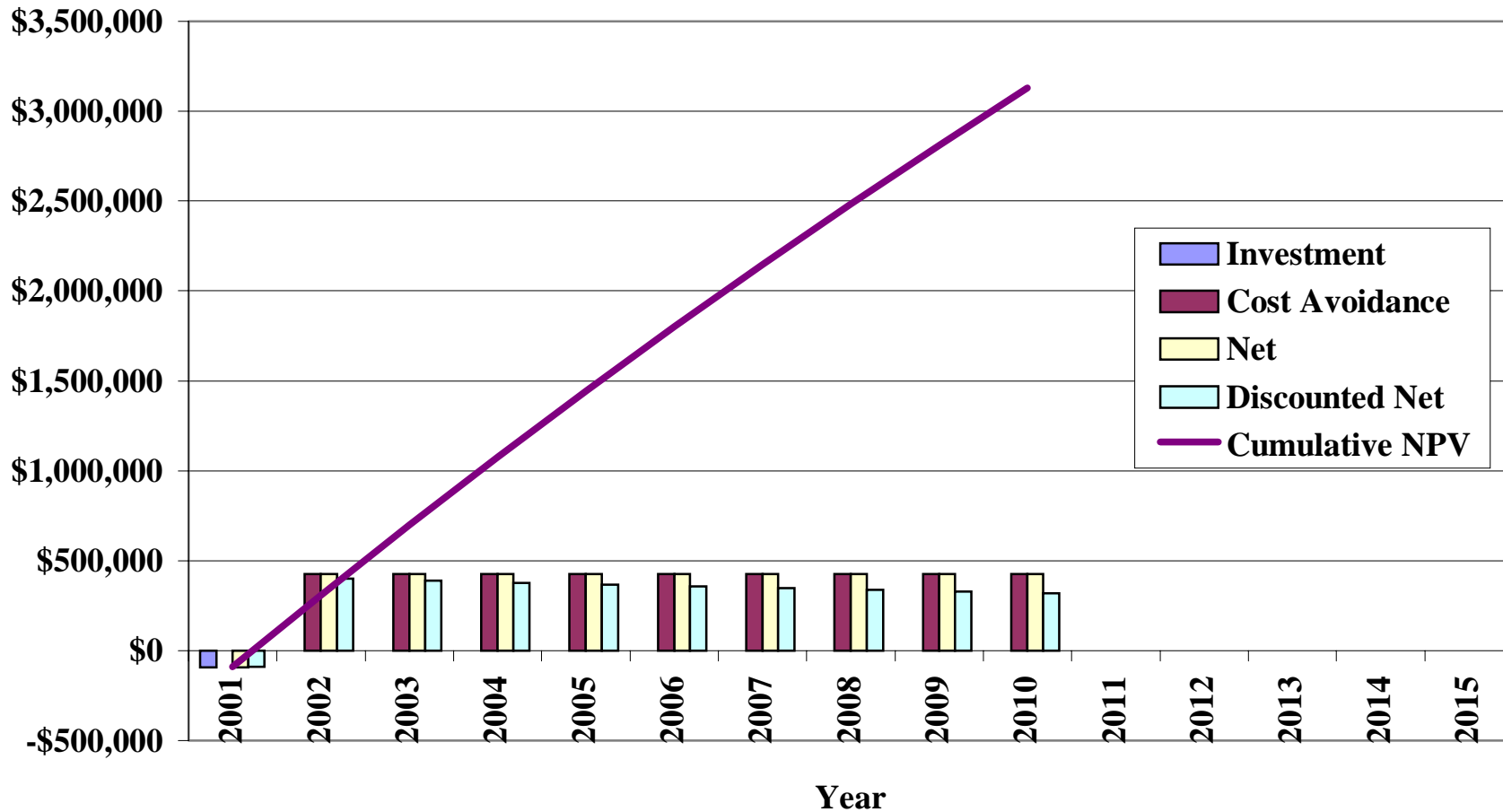


Clear Results for Decision-Makers

Deployment Sites	Investment	Payback (yr)	Internal Rate of Return	Net Present Value
25	\$4,812,500	3.49	28%	\$8,323,551
Baseline	\$192,500	0.61	84%	\$1,143,745
TRI Reductions				
Deployment Sites	TRI Materials Reductions (lbs/yr)	TRI Chemicals Reductions (lbs/yr)	Haz Waste Reduction (lbs/yr)	
25	140,439	42,581	96,585	
Baseline	8,273	2,508	5,690	

Show Discounted Cash Flows

Cash Flows



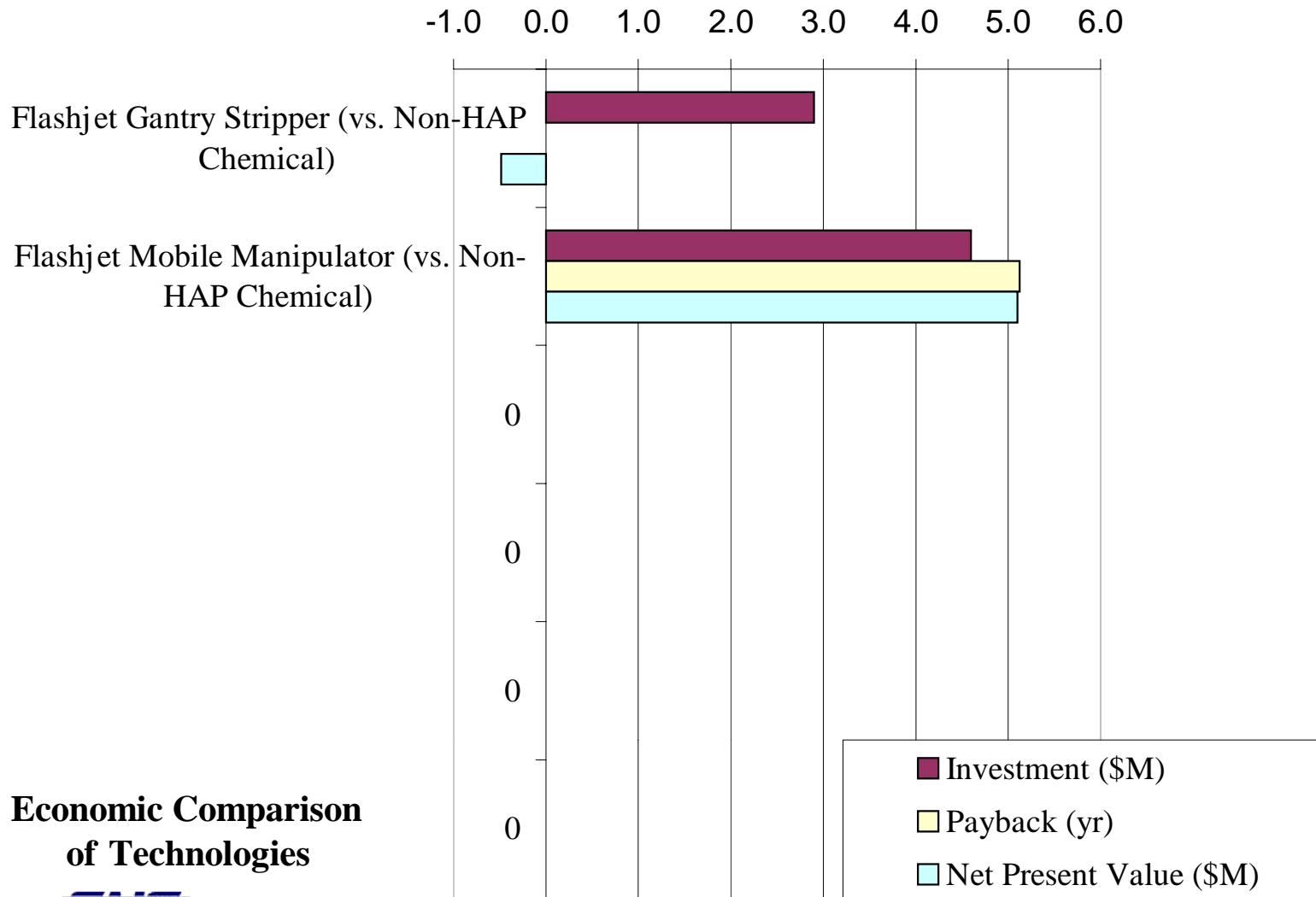
Generate Selected Site Lists

Sites Selected for Technology Deployment

Baseline	NAS FALLON	USS AMERICA CVA-66
MCAS BEAUFORT	NAS FORT WORTH	USS BELLEAU WOOD
MCAS CAMP PENDLETON	NAS GUANTANAMO	USS BOXER LHD-4
MCAS CHERRY POINT	NAS JACKSONVILLE	USS CARL VINSON CVN-70
MCAS FUTENMA	NAS KINGSVILLE	USS CONSTELLATION 64
MCAS IWAKUNI	NAS LEMOORE	USS EISENHOWER CVN-69
MCAS KANEOHE	NAS MERIDIAN	USS ENTERPRISE CVAN-65
MCAS MIRAMAR	NAS NEW ORLEANS	USS ESSEX LHD-2
MCAS NEW RIVER	NAS NORFOLK	USS G WASHINGTON
MCAS QUANTICO	NAS NORTH ISLAND	USS GUAM
MCAS YUMA	NAS OCEANA	USS INCHON
NADEP CP	NAS PATUXENT RIVER	USS INDEPENDENCE CV-62
NADEP NORIS	NAS PENSACOLA	USS KEARSARGE LHD-3
NAF ATSUGI	NAS POINT MUGU	USS KITTY HAWK CVA-63
NAF CHINA LAKE	NAS WHIDBEY IS	USS NASSAU

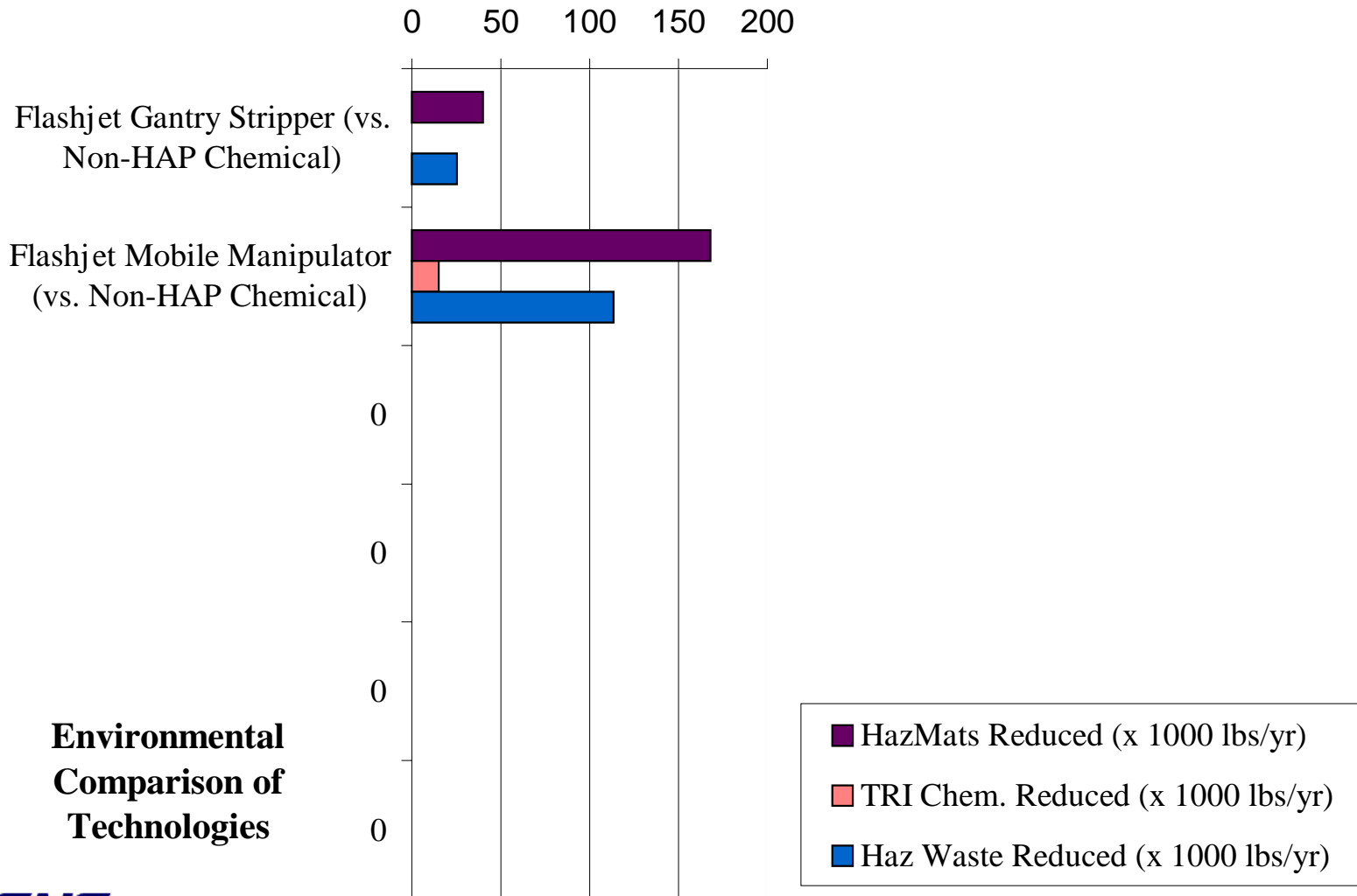


Compare Alternative Technologies



Economic Comparison of Technologies

Environmental Metric Comparison



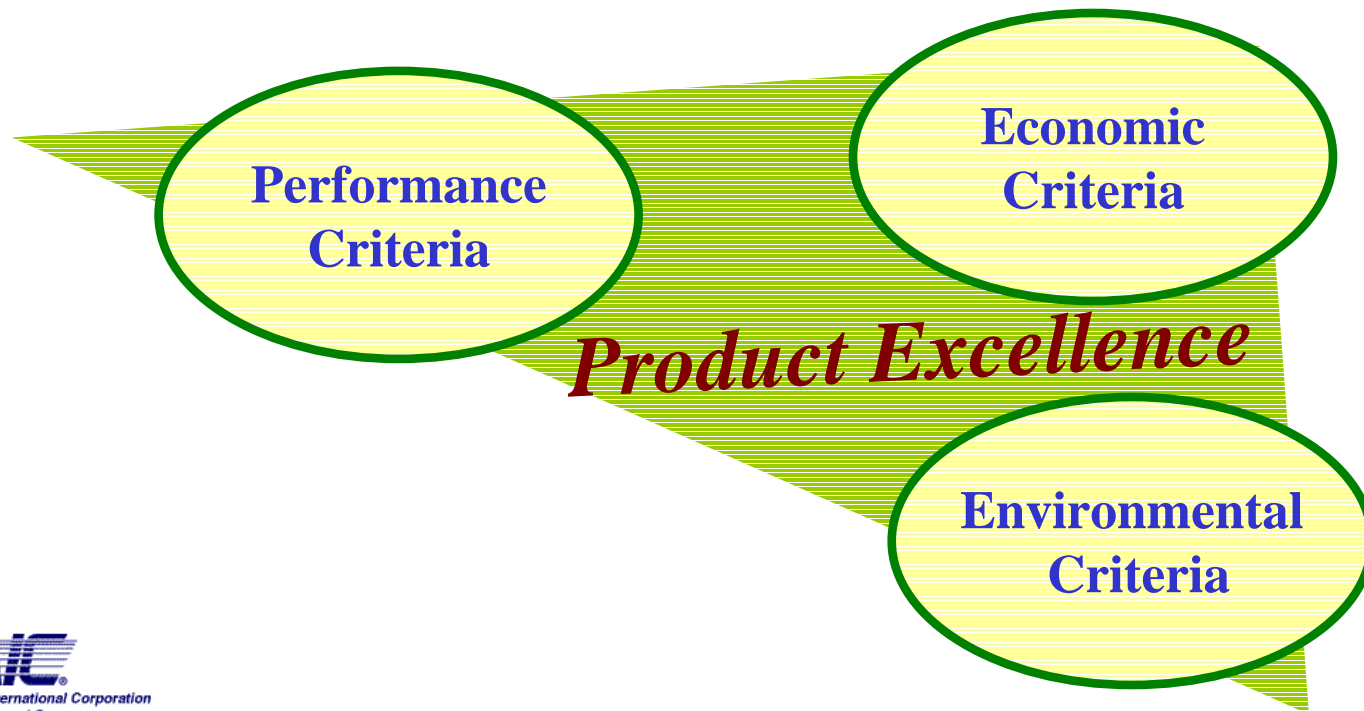
Environmental Comparison of Technologies

Now, Descend from the Ivory Tower

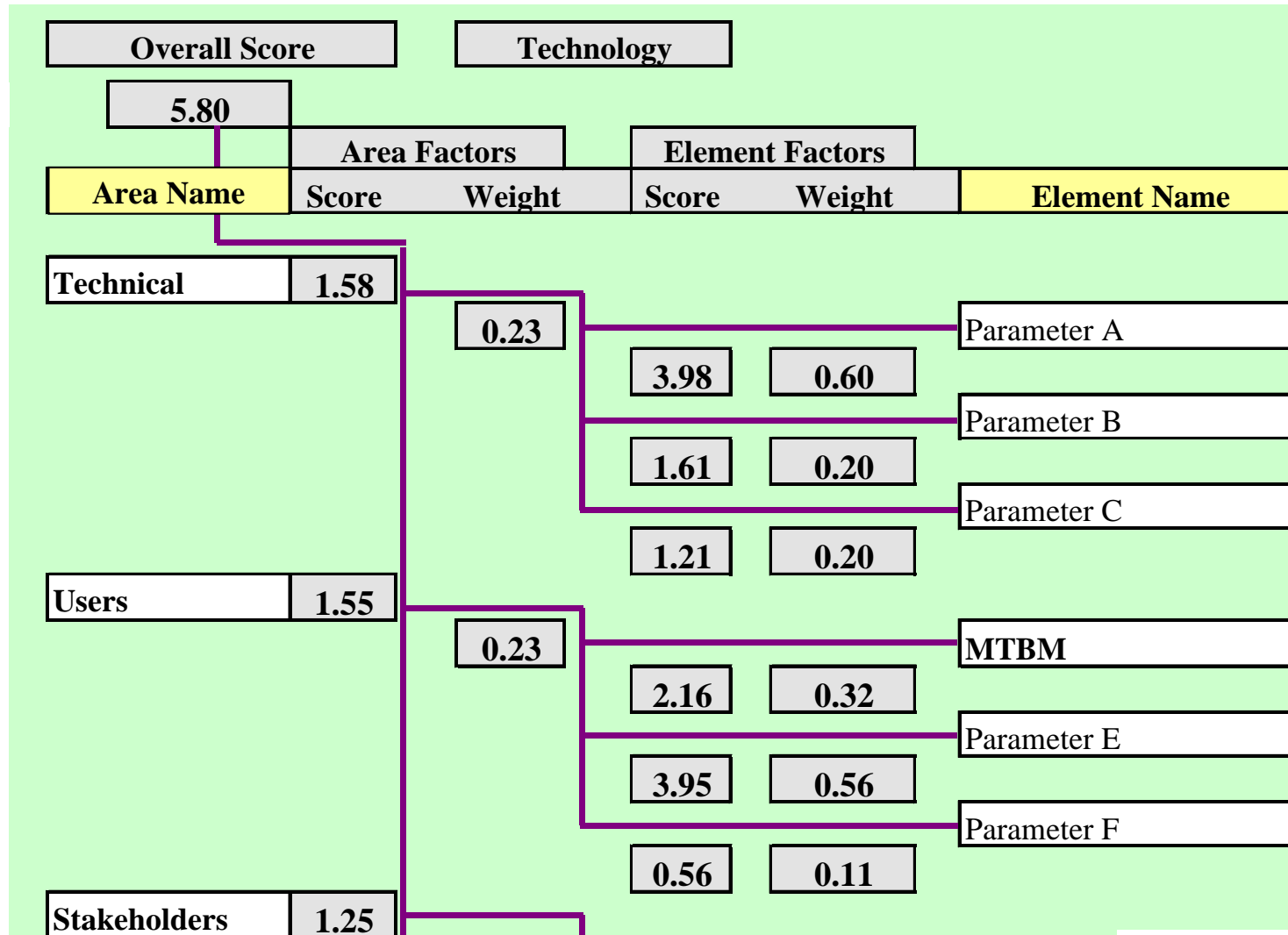
- Impact Analysis
 - Life Cycle Assessment Principles
 - Consistent Comparisons between Alternative Technologies on Economic and Environmental Basis
 - You care. Do other Stakeholders ?
- *Comprehensive* Analysis
 - The Next Level: Realistic product comparisons
 - Factor in the Technical Performance of the material, product, or process
 - Factor in User or Customer Satisfaction Values

Comprehensive Life Cycle Assessment

- Consider Performance Measures of Merit
 - Requirements & Specifications
 - User Satisfaction Values
 - Design-to-Cost technical parameters

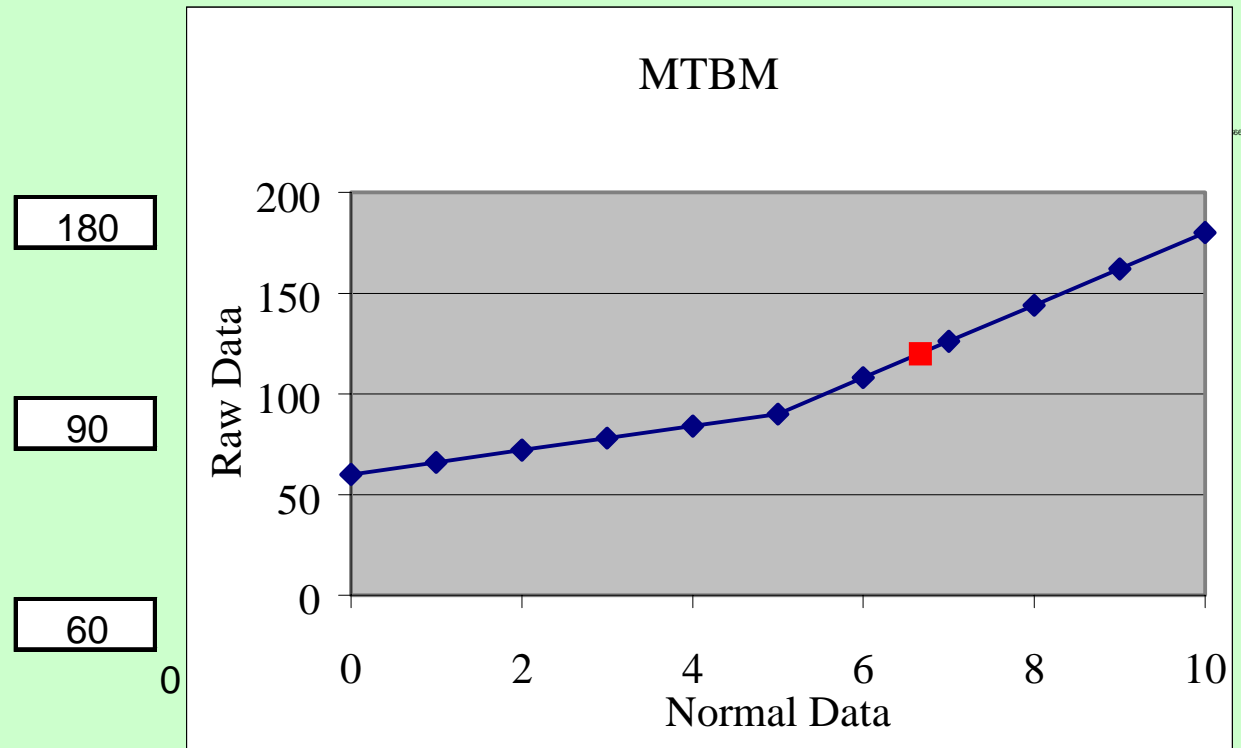


Analytical Hierarchy Process -- via a MS Excel® spreadsheet



Assess Qualitative and Quantitative Parameters

- **Qualitative:**
 - Compare New Technology to Others
- **Quantitative:**
 - Test Results versus Specifications
 - Built-in Data Normalization



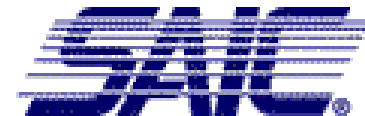
Questions?

Bill Custer

Science Applications International Corporation

custerw@saic.com

805-488-1919



Science Applications International Corporation
An Employee-Owned Company