

# Selecting an Airport Vulnerability Assessment Methodology

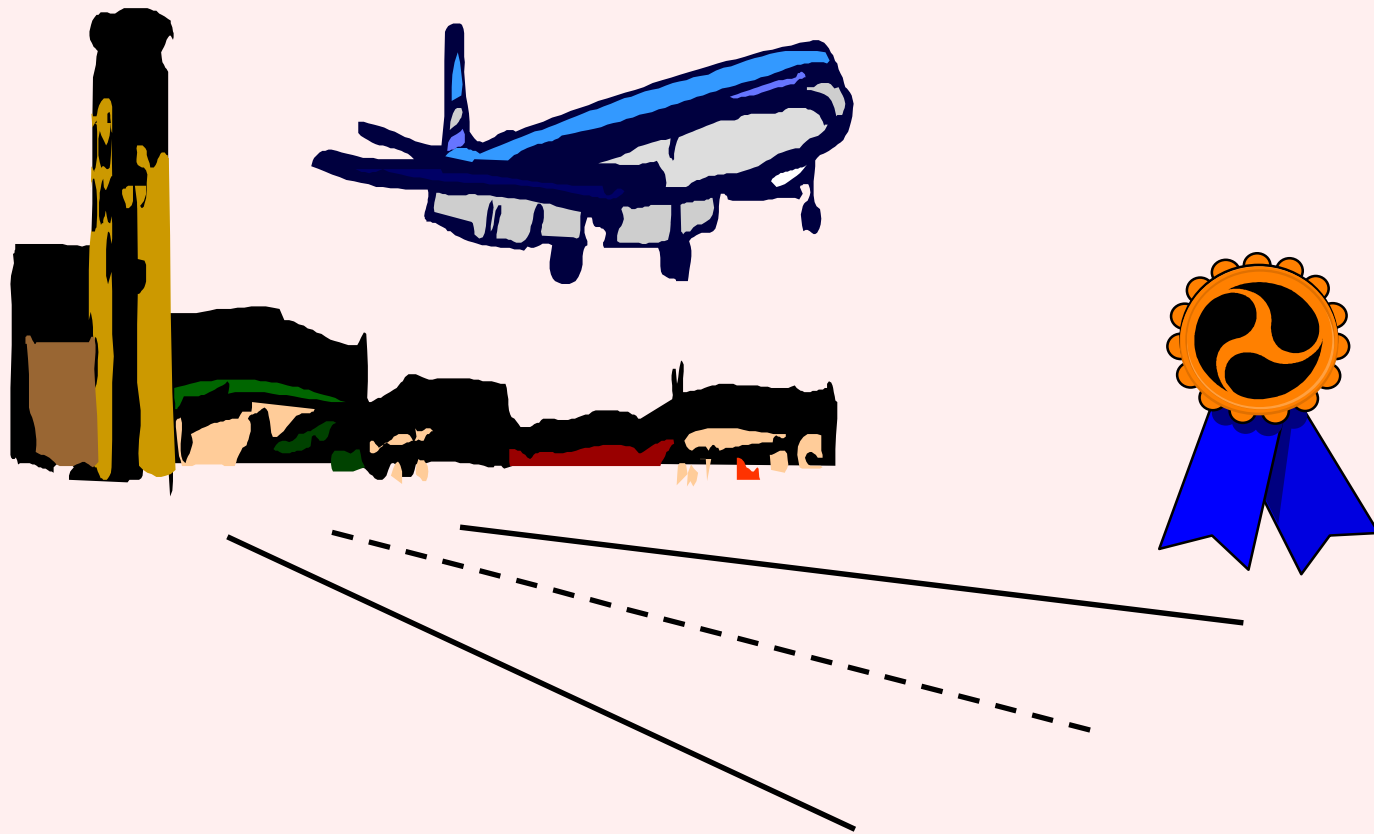
**Presented at  
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May 10, 2000**

**by  
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Argonne National Laboratory  
Decision and Information Sciences Division**

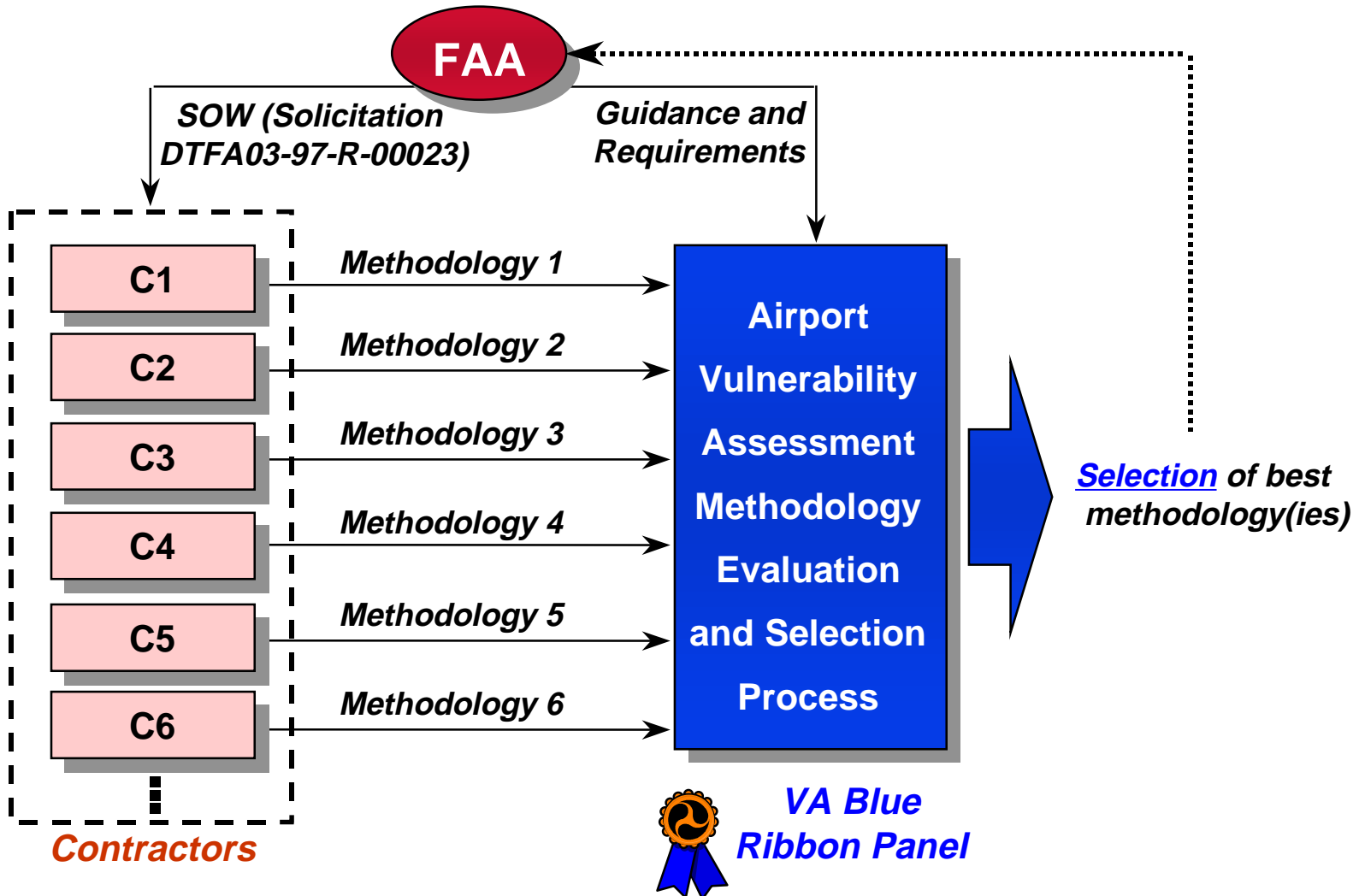
**Rick Lazarick  
Federal Aviation Administration**



# Selecting Airport VA Methodologies

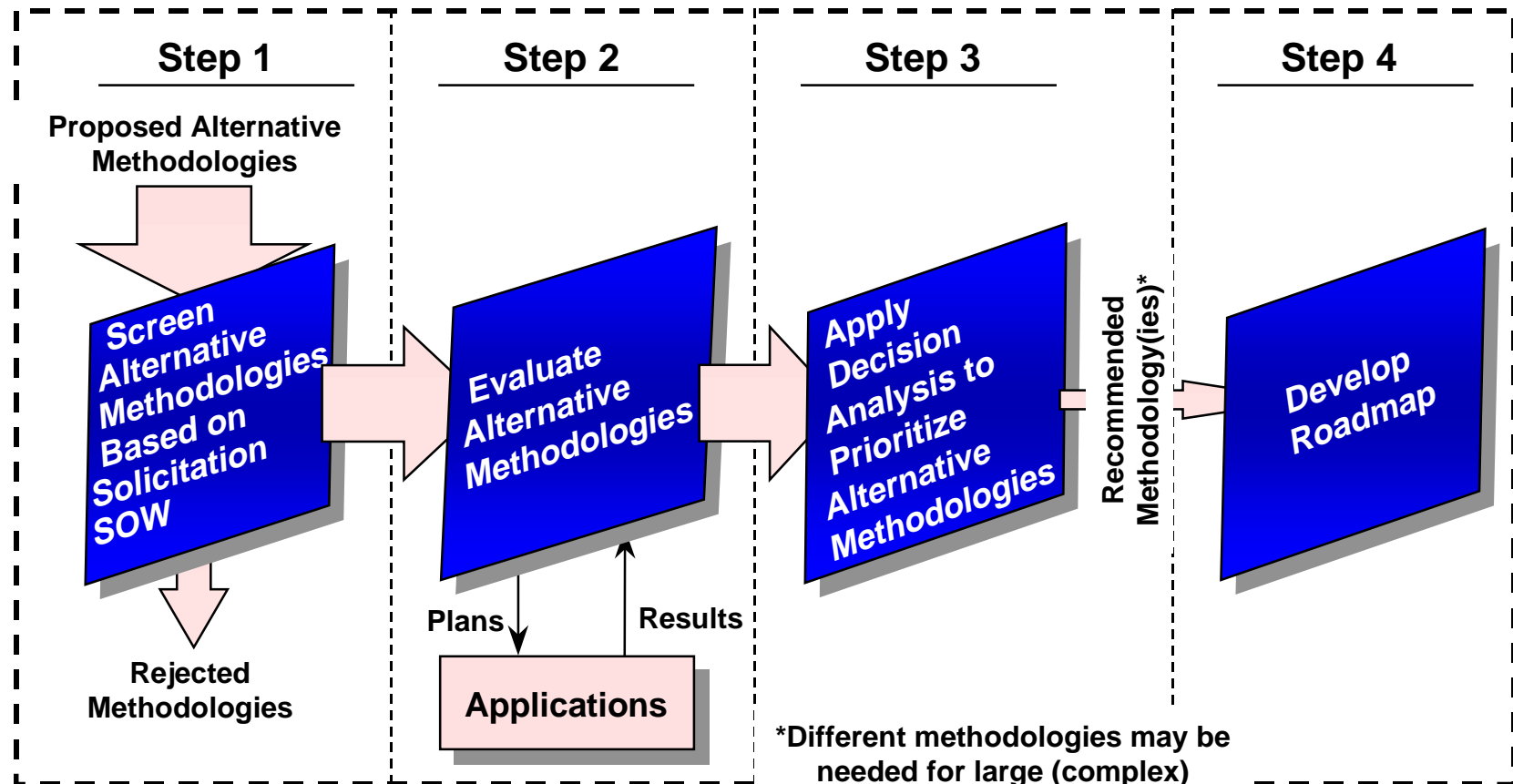


# A Systematic Process Was Used to Evaluate and Select Airport VA Methodologies

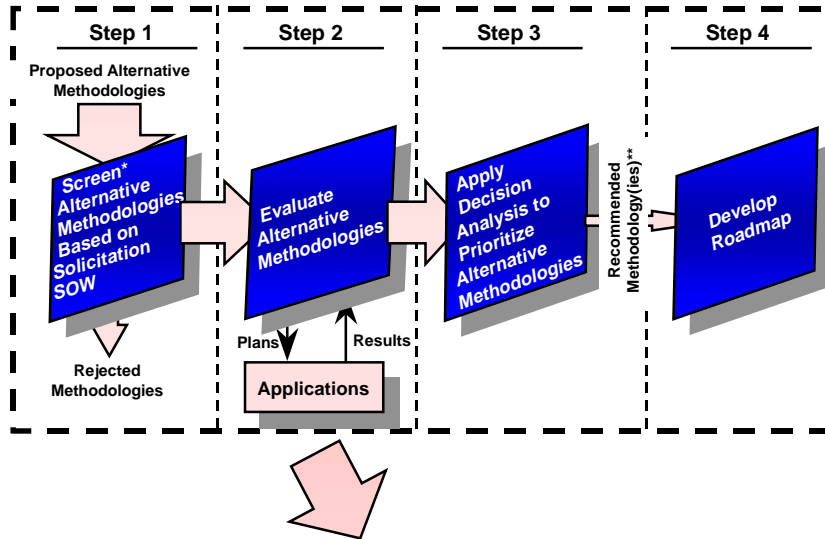


# The Evaluation and Selection Process Consists of Four Interrelated Steps

## *Airport Vulnerability Assessment Methodology Evaluation and Selection Process*



# Airport Vulnerability Assessment Methodology Evaluation and Selection Process



## Step 2: Evaluate Alternative Methodologies

- Identify criteria
- Develop measurement scales
- Characterize alternative methodologies

## Criteria Possessed Several Important Properties

- ❑ **Comprehensive:** Cover all important aspects of the evaluation and selection problem
- ❑ **Meaningful:** Discriminate among the alternative methodologies
- ❑ **Nonredundant:** Avoid double counting of possible consequences
- ❑ **Measurable:** Develop scales to measure degrees of achievement

## Criteria for Evaluating Alternative Vulnerability Assessment Methodologies

1. **Technical credibility** -- is the methodology technically sound
2. **Comprehensiveness** -- does the methodology address all important dimensions of the airport security planning process
3. **Usefulness** -- are the outputs understandable, meaningful, and useful for making decisions
4. **Usability** -- what user skill level is needed to apply the methodology
5. **Ease of implementation** -- how intrusive and/or difficult is it (i.e., in terms of time and availability) to gather required input information

## Criteria for Evaluating Alternative Vulnerability Assessment Methodologies (cont'd)

- 6. Flexibility** -- can the methodology be applied to the range of threat scenarios and airport sizes, configurations, and complexities of interest
- 7. Applicability** -- is the methodology applicable to other operational, but not public-safety related, security interests
- 8. Subjective Judgments** -- how extensively are subjective judgments used in the assessment process
- 9. Cost** -- what is the total life-cycle cost of the analysis process (hardware, software, technical support)

## Criterion 1: Technical credibility

**Definition:** The degree to which the methodology is technically sound and provides reproducible results. This criterion reflects the inherent scientific and technical quality of the methodology and the level of technical credibility in its application to the assessment problem. This includes proper treatment of uncertainty.

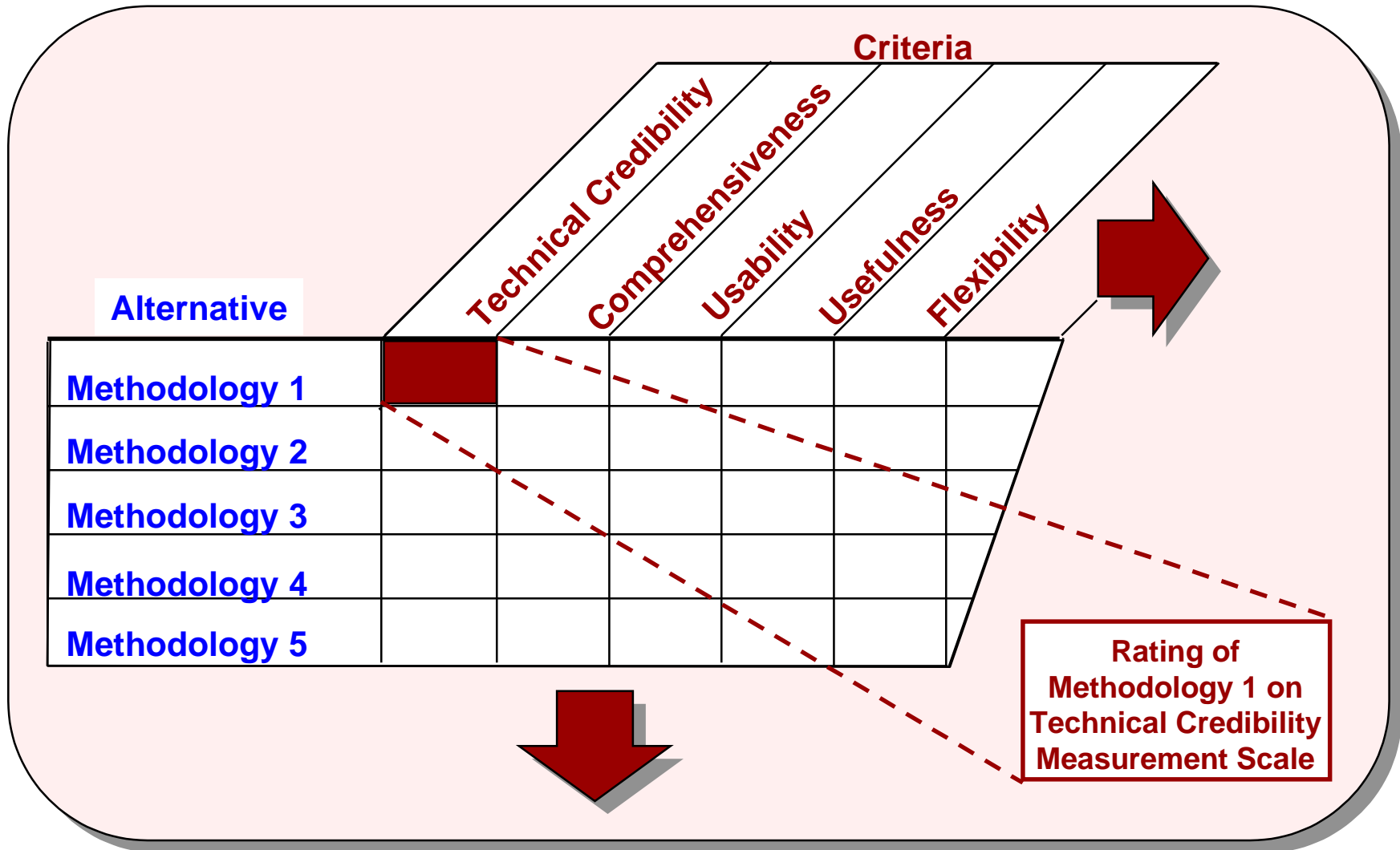
- Scale:**
- (3) **High** -- high level of technical credibility with strong theoretical underpinnings
  - (2) **Medium** -- technically credible with adequate theoretical underpinnings
  - (1) **Low** -- low level of technical credibility with weak theoretical underpinnings

## Criterion 2: Comprehensiveness

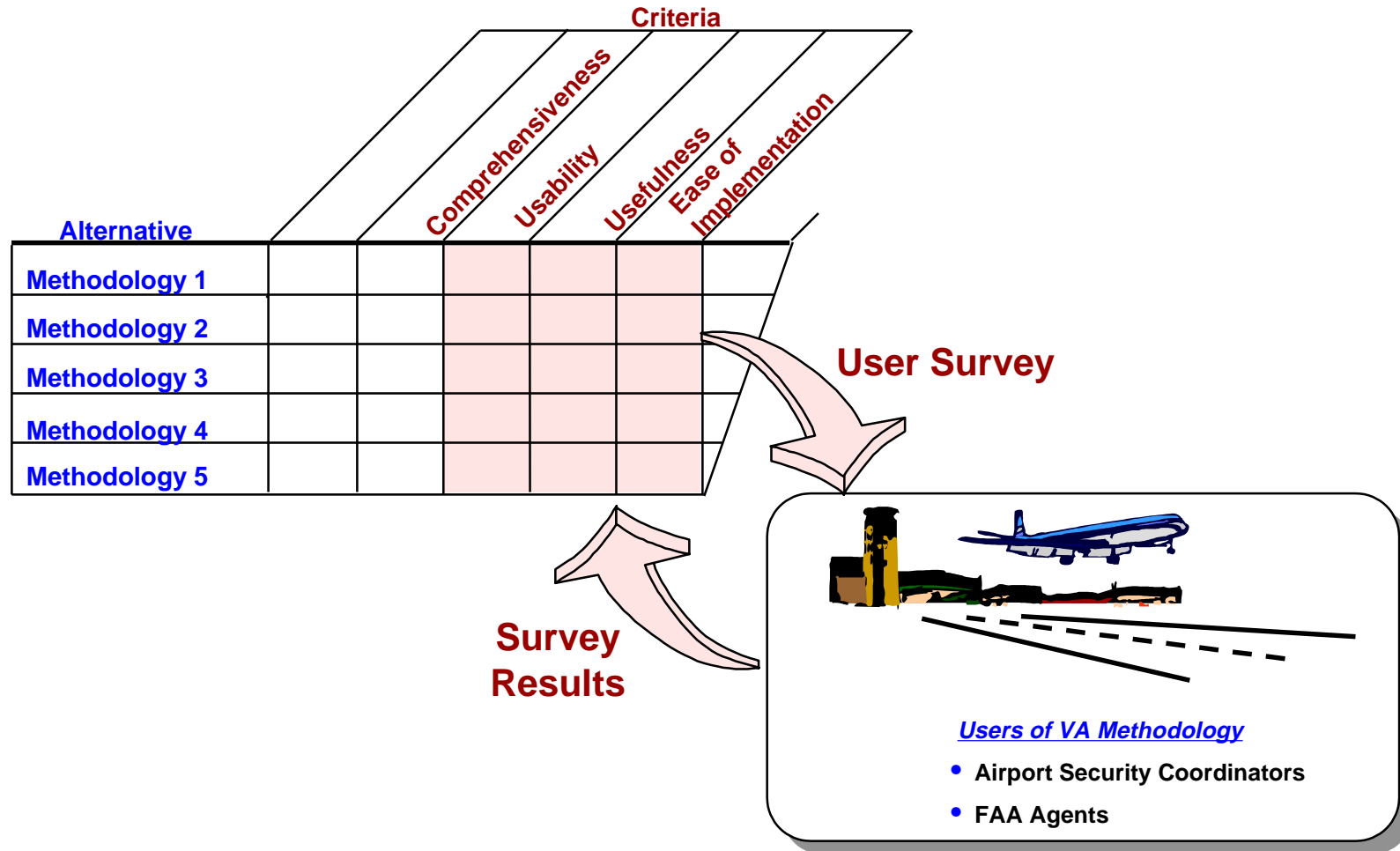
**Definition:** The degree to which the methodology addresses important dimensions of the airport security planning process: evaluating countermeasure tradeoffs, risk assessment, and cost/benefit analysis

- Scale:**
- (4) **Outstanding** -- the methodology is strong on all of these dimensions
  - (3) **Good** -- the methodology is strong on countermeasure tradeoffs but weak on one of the other dimensions
  - (2) **Fair** -- the methodology is strong on countermeasure tradeoffs but weak on the other two dimensions
  - (1) **Poor** -- the methodology is weak on all three of these dimensions

# Alternative Methodologies Were Characterized in Terms of Each of the Criteria



# A User Survey Provides Valuable Information on Usefulness, Usability, and Ease of Implementation

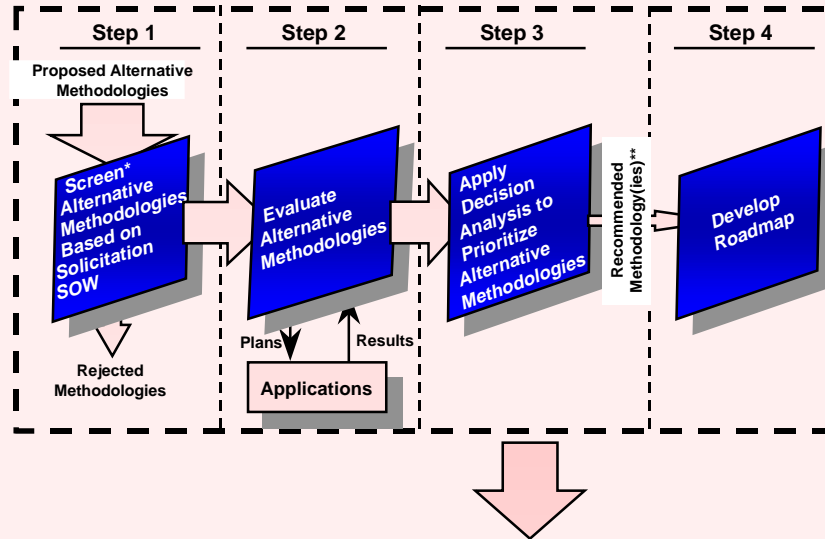


# Scoring Responsibilities

Criteria		Scoring Done By		
		BRP	Users*	FAA/HQ
Effectiveness Criteria	1 Technical Credibility	<input type="checkbox"/>		<input type="checkbox"/>
	2 Comprehensiveness	<input type="checkbox"/>		<input type="checkbox"/>
	3 Usefulness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4 Usability	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	5 Ease of Implementation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	6 Flexibility	<input type="checkbox"/>		<input type="checkbox"/>
	7 Applicability	<input type="checkbox"/>		<input type="checkbox"/>
	8 Subjective Judgments	<input type="checkbox"/>		<input type="checkbox"/>
Cost	9 Total Life-Cycle Cost 9a Hardware Cost 9b Software Cost 9c Technical Support Cost	<input type="checkbox"/>		<input type="checkbox"/>

\*Results of a survey of airport Security Coordinators and FAA Agents

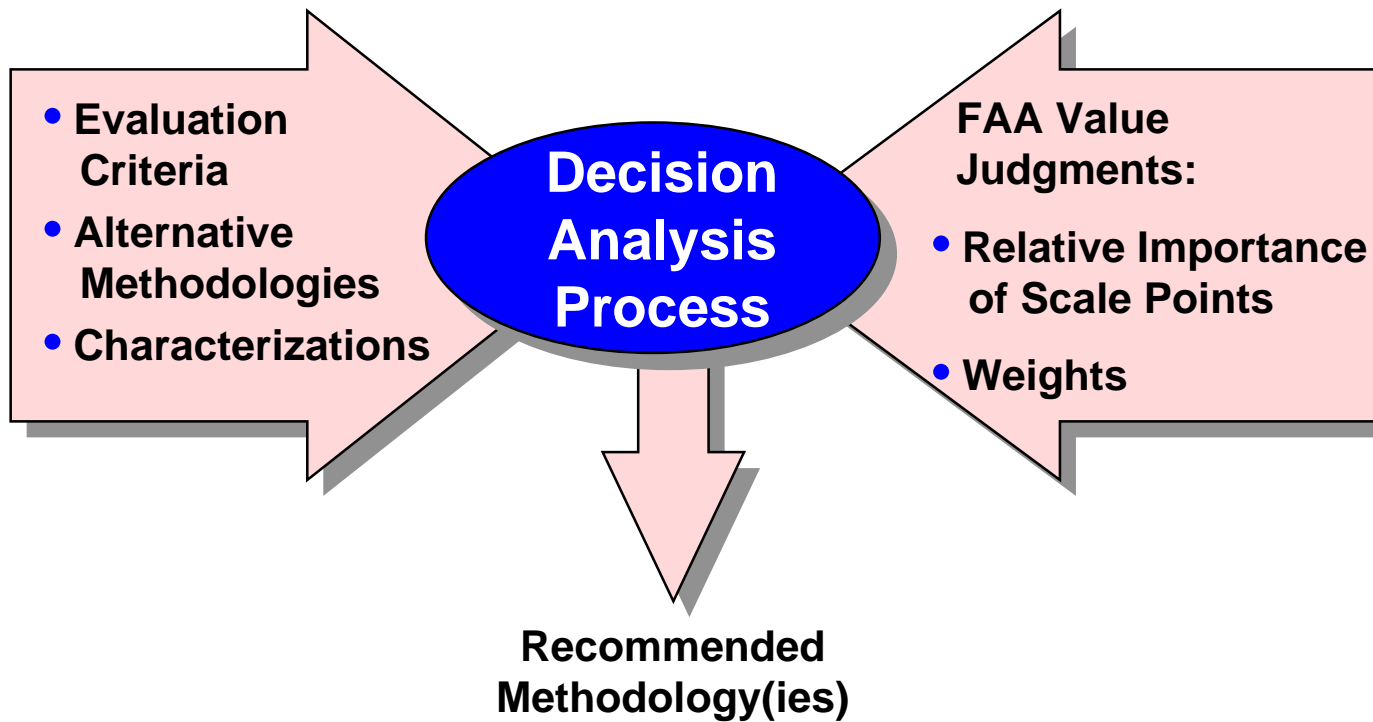
# Airport Vulnerability Assessment Methodology Evaluation and Selection Process



## Step 3: Apply Decision Analysis to Prioritize Alternative Methodologies

- Determine relative importance of scale points for each criterion
- Determine relative importance (weights) of criteria
- Combine the value information with the methodology evaluations to prioritize the methodologies

# A Decision Analysis Was Used to Develop Recommendations



## Value Judgments Were Obtained from Staff from Four FAA Organizations

- R&D*
- Policy*
- Operations*
- Field*

# A Software Tool Was Developed in Excel to Facilitate the Characterization Step

Microsoft Excel - eval1.xls

File Edit View Insert Format Tools Data Window Help

Arial 10 B I U

E8 = 50%

1 **HELP**

2 **Probabilities for Each Scale Level - by Criteria**

3 Methodology:  Evaluator:

4

5

6 **Worst ← Scale Levels → Best**

7 **A: Low/Poor B: Medium/Fair C: High/Good D: Outstanding**

8 **Criteria**

	A: Low/Poor	B: Medium/Fair	C: High/Good	D: Outstanding	Total Criterion Probability
1. Technical Credibility		20%	80%		100%
2. Comprehensiveness		50%	2%		52%
3. Usefulness		97%		3%	100%
4. Usability		97%		3%	100%
5. Ease of Implementation		100%			100%
6. Flexibility		100%			100%
7. Applicability		100%			100%
8. Subjective Judgments		100%			100%
9a. Hardware Cost		100%			100%
9b. Software Cost		99%	1%		100%
9c. Technical Support Cost		96%	4%		100%

20 **Comprehensiveness** -- The degree to which the methodology addresses important dimensions of the airport security planning process: evaluating countermeasure tradeoffs, risk assessment, and cost/benefit analysis.

21 **Fair** -- the methodology is weak on two of these dimensions

22

23

24

ByCriteria ByMethod

Ready NUM

Start MaxTime MS-DOS Prompt Microsoft PowerPoint - [f... Microsoft Excel - ev... 3:36 PM

**Evaluate All Criteria for One Methodology**

# A Software Tool Was Developed in Excel to Facilitate the Characterization Step

**Microsoft Excel - eval1.xls**

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D8 = 60%

**Probabilities for Each Scale Level - by Methodology**

Criterion: 1. Technical Credibility Evaluator: Mark Jusko

Worst ← Scale Levels → Best

Methodologies	A: Low/Poor	B: Medium/Fair	C: High/Good	D: Outstanding	Total Criterion Probability
Methodology 1		20%	80%		100%
Methodology 2	60%	12%	15%		87%
Methodology 3	50%	12%	15%		77%
Methodology 4	1%	99%			100%
Methodology 5	60%	12%	15%		87%
Methodology 6	60%	12%	15%		87%
Methodology 7	60%	12%	15%		87%
Methodology 8	1%	2%	2%		5%

**Technical Credibility** -- The degree to which the methodology is technically sound and provides reproducible results. This criterion reflects the inherent scientific and technical quality of the methodology and the level of technical credibility in its application to the assessment problem. This includes proper treatment of uncertainty.

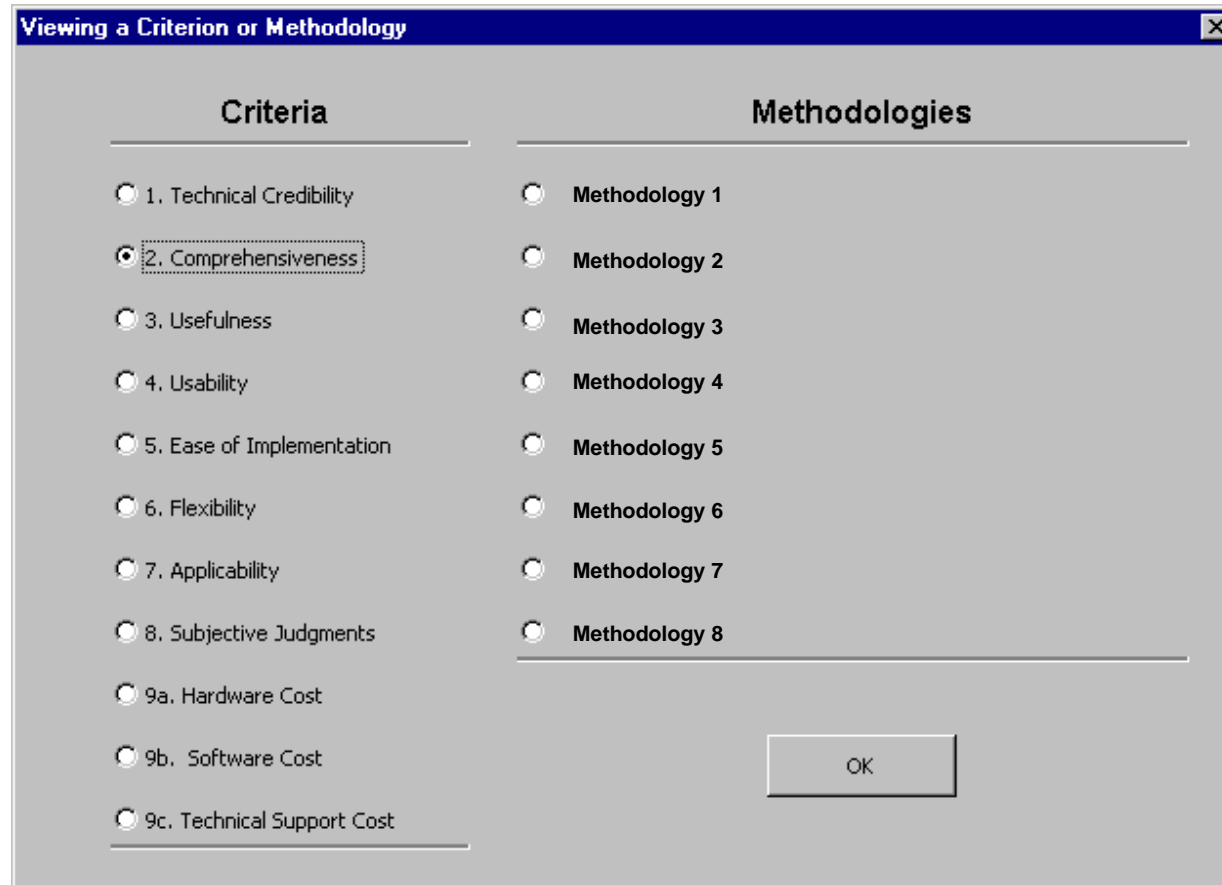
**Low** -- low level of technical credibility with weak theoretical underpinnings

Ready NUM

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*Evaluate All Methodologies on One Criterion*

# A Software Tool Was Developed in Excel to Facilitate the Characterization Step



The screenshot shows a window titled "Viewing a Criterion or Methodology" with a close button in the top right corner. The window is divided into two columns: "Criteria" and "Methodologies".

**Criteria**

- 1. Technical Credibility
- 2. Comprehensiveness
- 3. Usefulness
- 4. Usability
- 5. Ease of Implementation
- 6. Flexibility
- 7. Applicability
- 8. Subjective Judgments
- 9a. Hardware Cost
- 9b. Software Cost
- 9c. Technical Support Cost

**Methodologies**

- Methodology 1
- Methodology 2
- Methodology 3
- Methodology 4
- Methodology 5
- Methodology 6
- Methodology 7
- Methodology 8

An "OK" button is located at the bottom right of the window.

*There Is a Window for Switching between Criteria and Methodologies*

# A Second Software Tool Was Developed to Facilitate the Evaluation Step

The screenshot shows a Microsoft Excel spreadsheet with a table of XLS file names and dates. A dialog box is overlaid on the spreadsheet, providing instructions and options for evaluation.

XLS File Name	Evaluator	Date Created	
c:\Vaa\sc1snl.xls	SNL	9/28/98 4:05 AM	<input checked="" type="checkbox"/>
c:\Vaa\sc1orni.xls	ORNL	9/28/98 3:59 AM	<input checked="" type="checkbox"/>
c:\Vaa\sc1anl.xls	ANL	9/28/98 3:51 AM	<input checked="" type="checkbox"/>
c:\Vaa\sc1bnl.xls	BNL	9/28/98 3:53 AM	<input checked="" type="checkbox"/>
c:\Vaa\sc1ace.xls	ACE	9/28/98 10:47 AM	<input checked="" type="checkbox"/>
c:\Vaa\sc1faa-1.xls	FAA-1	9/28/98 3:55 AM	<input checked="" type="checkbox"/>
	FAA-2		<input type="checkbox"/>
	FAA-3		<input type="checkbox"/>
	FAA-4		<input type="checkbox"/>
			<input type="checkbox"/>
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Dialog Box Content:

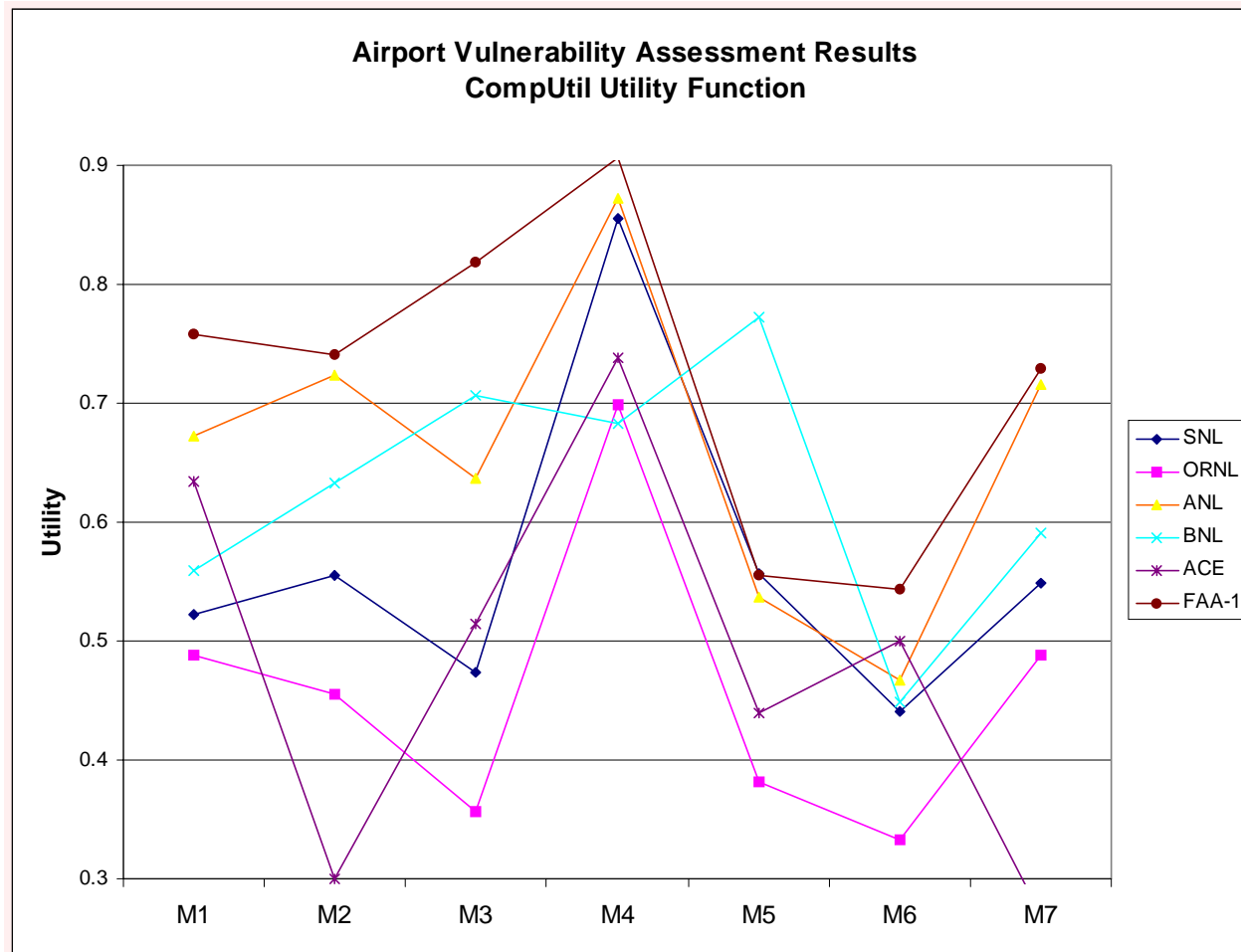
Check the evaluations and utility functions of interest, then click "View Results".

Buttons: Load Evaluations, Calculate Results, View Results

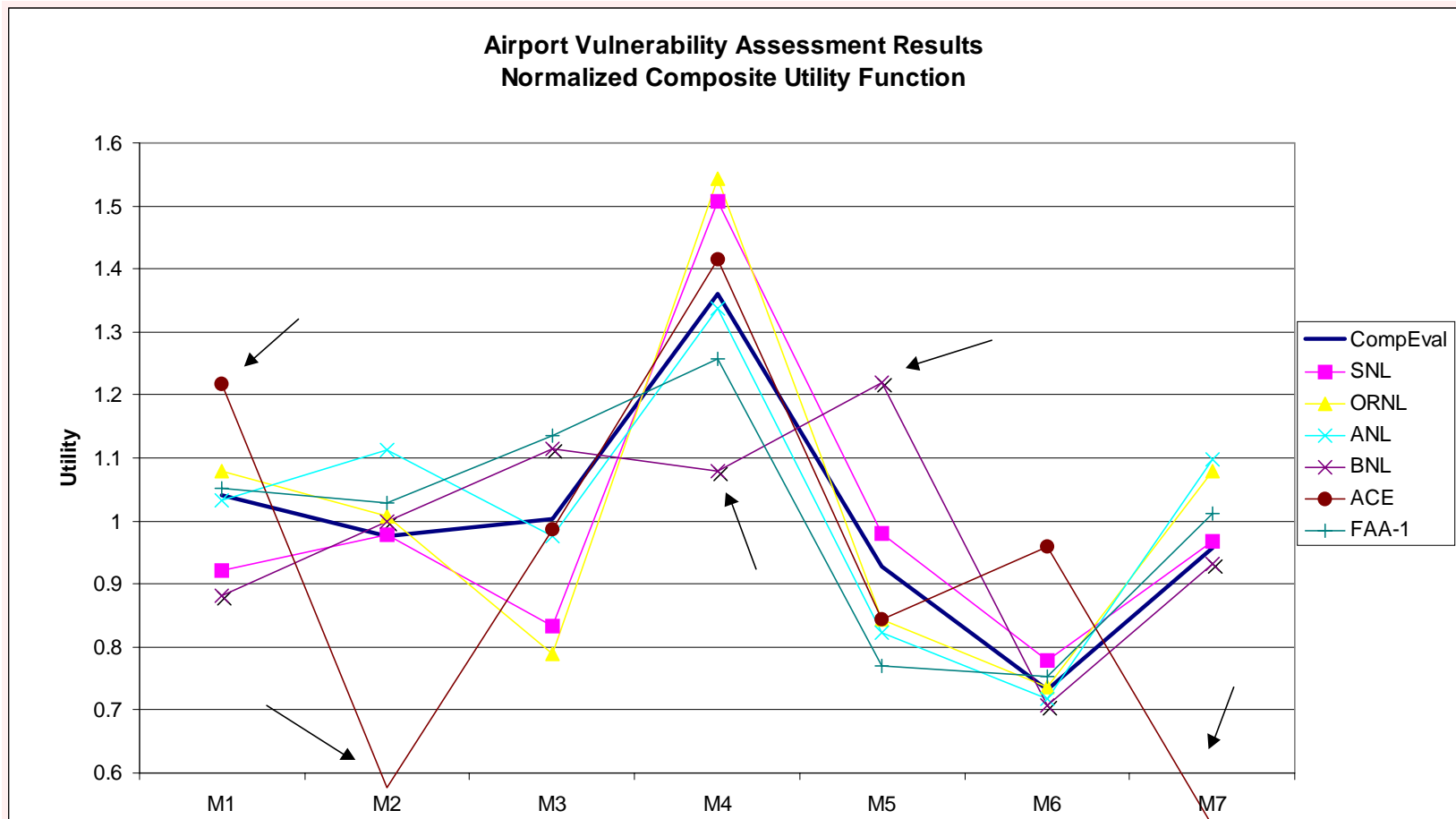
Options:

- Composite Evaluation (Can also check other evaluations shown at left in column D.)
- CompUtil
- R&D
- Policy
- Operations
- Field

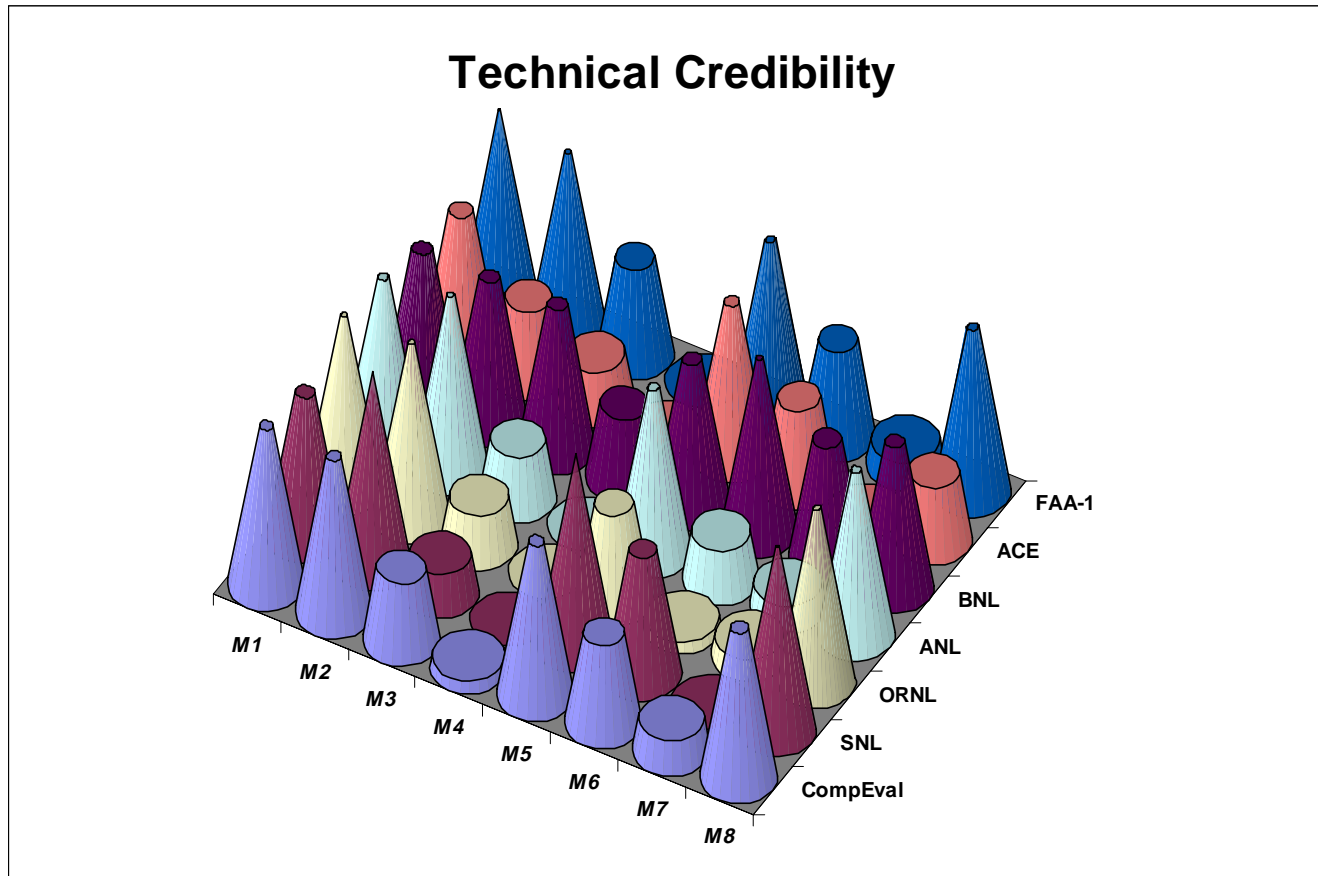
# Graphs Summarize and Illuminate Salient Features and Implications of the Analysis



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*This graph summarizes the technical credibility scores assigned by each evaluator.*

## Postscript to the Selection of a Methodology

- ❑ **6 agents were trained**
- ❑ **The agents worked in pairs**
- ❑ **Each pair assessed 2 airports**
- ❑ **Discussions at a follow-up meeting of airport security personnel and agents were positive about the experience**
  - The tool was workable
  - Results were useful
  - The tool and process helped participants to identify important security issues
  - The process serves as an effective self audit

## Efforts Continue to Expand the Use of the Tool

- More agents will be trained**
- A transition to operations is underway**
- A full-scale “roll-out” is planned for 2001**
- Technical and political support is increasing**
  - Addressing concerns that a self-audit will eventually have regulatory implications
  - Addressing concerns that revealing weaknesses may lead to penalties

## Final Comments (from Rick Lazarik)

- He slept well at night because he was confident that he had a defensible selection process
- He is confident that the process led to selection of the best methodology (and activities in the past year confirm that the methodology is operationally viable)
- Because there were no complaints from the organizations that were not selected to participate in the follow-up development, he concludes that he was correct about having a defensible selection process