Headquarters U.S. Air Force

Integrity - Service - Excellence

Air Force Human Systems Integration – Capabilities and Requirements Tool (HSI-CRT)

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Overview

- Background
- HSI-CRT Design and Development
- Validation and Verification of Question Sets
- HSI-CRT Usability Study
- Summary
- Discussion

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Background

- **Mission**
  - The mission of the 711th Human Systems Integration Directorate (711 HPW/HP) and purpose of Human Systems Integration (HSI) is to optimize warfighter capability through a human-centric approach to system development, acquisition, and sustainment.
- **Problem Statement**
  - 711 HPW/HP lacked an integrated approach for the inclusion of HSI in early systems engineering processes and documents such as the Capabilities-Based Assessment (CBA), Analysis of Alternatives (AoA) and Development Planning (DP).
- **Solution**
  - Develop an integrated tool for addressing human performance related issues in the CBA, AoA, and DP processes and documents to introduce HSI best practices within the DoD and affiliated acquisition processes.

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HSI-CRT Design and Development

- Conduct a comprehensive literature review to gather and review pertinent information related to CBA, AoA, and DP
  - **Force Structure, Resources, and Assessment Directorate (JCS-J8). (2009, March).**
  - **Capabilities-Based Assessment (CBA) User's Guide Version 3.**
  - **Analysis of Alternatives (AoA) Handbook**
  - **Concept Characterization and Technical Description (CCTD) Guide**
  - **Development Planning (DP) Guide**
  - Analysis Handbook, A Guide for Performing Analysis Studies: For Analysis of Alternatives or Functional Solutions Analyses, Office of Aerospace Studies, July 2004
  - HSI and ESOH Handbook for Pre-Milestone A JCIDS and AoA Activities
  - Capabilities-Based Assessment for Critical Care Air Transport, Force Health Protection (FHP) CBA, T-X FoS CCTD, T-X CCTD Review, HSI Role in the AoA (Applied Training presentation for 711 HPW/HP), PAR AoA, SRD Guidebook, HSI Requirements Guide
- Develop comprehensive question sets for the CBA, AoA, and DP
- Develop a strategy for assessing HSI related risks

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Questions and Risk Assessment Strategy

- **Reviewed the *Risk Management Guide for DoD Acquisition* in order to develop a strategy for risk assessment**
- **Held Technical Interchange Meetings with Subject Matter Experts**
  - Leveraged HSI Practitioners and Domain SMEs
- **Leveraged Risk Identification: Integration & Ilities (RI3) application as a framework/guide in developing the interactive tool**
  - Provide questions that inherently highlight a best practice in an area
    - Questions are formulated in such a manner that a positive response indicates that the “best practice” is being followed

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Questions and Risk Assessment Strategy

- **Developed three question sets for the CBA, AoA, and DP aligned to each HSI domain**
  - CBA – 122 questions
  - AoA – 168 questions
  - DP – 78 questions
- **Developed an approach to ensure that HSI Tradeoffs are being considered as part of the analysis**
  - HSI Tradeoff Considerations – 9 Questions

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Questions and Risk Assessment Strategy

Sample Questions

AoA	CBA	DP
Have manpower requirements been identified for each alternative?	Was a Manpower-Expert part of the CBA Analysis Team?	Have specific Manpower concepts been identified and documented with respect to capability gaps, mission tasks, MOEs, MOPs, MOSs, operational concepts, and support concepts?

Yes

- Next Question (Do not include in the Risk Matrix)
- Provide evidence of best practice occurring

No

- Assess Likelihood (the likelihood of best practice not occurring)
- Assess Consequence (the impact on the program if the best practice does not occur)
- Provide rationale for negative response

Not Applicable

- Provide rationale for why the question is not applicable

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Questions and Risk Assessment Strategy

- **Likelihood:** The probability of the best practice (stated in the question) **NOT** occurring *(Assigned by the user)*

Level	Likelihood	Probability of Occurrence
1	Not Likely	0% - 20%
2	Low Likelihood	21% - 40%
3	Likely	41% - 60%
4	Highly Likely	61% - 80%
5	Near Certainty	81% - 100%

- **Consequence:** The impact (consequence) on the program if the best practice does **NOT** occur *(Assigned by the user)*

Level	Consequence
1	Minimal or no consequence to human effectiveness and performance with minimal or no impact on program success
2	Minor reduction in human effectiveness and performance with little or no impact on program success
3	Moderate reduction in human effectiveness and performance with limited impact on program success
4	Significant degradation in human effectiveness and performance; may jeopardize program success
5	Severe degradation in human effectiveness and performance; will jeopardize program success

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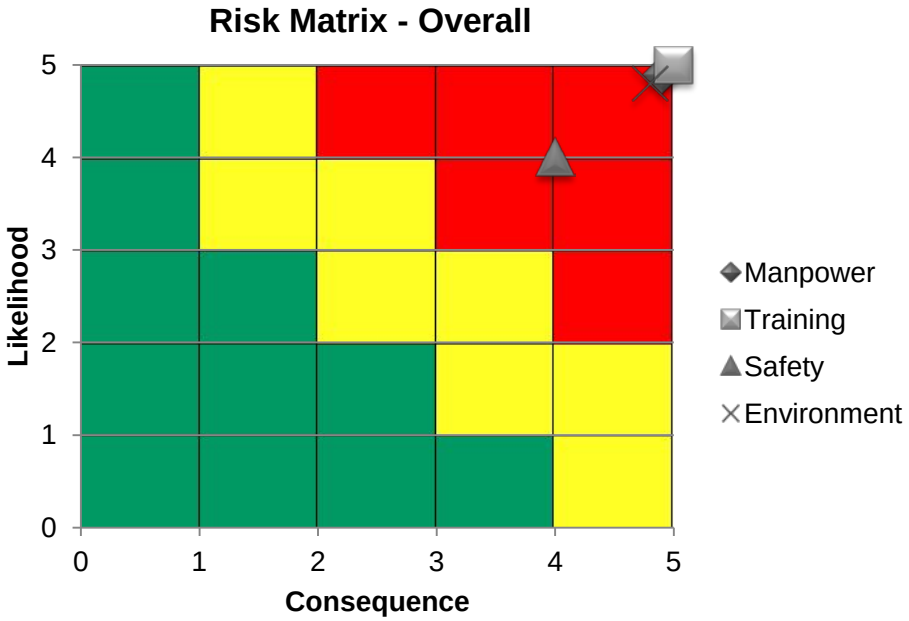
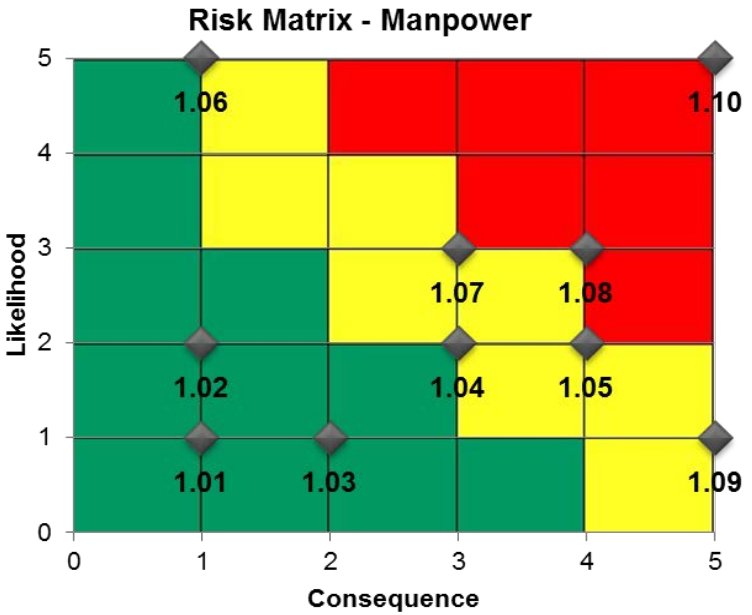
Questions and Risk Assessment Strategy

Overall



Domain- Specific



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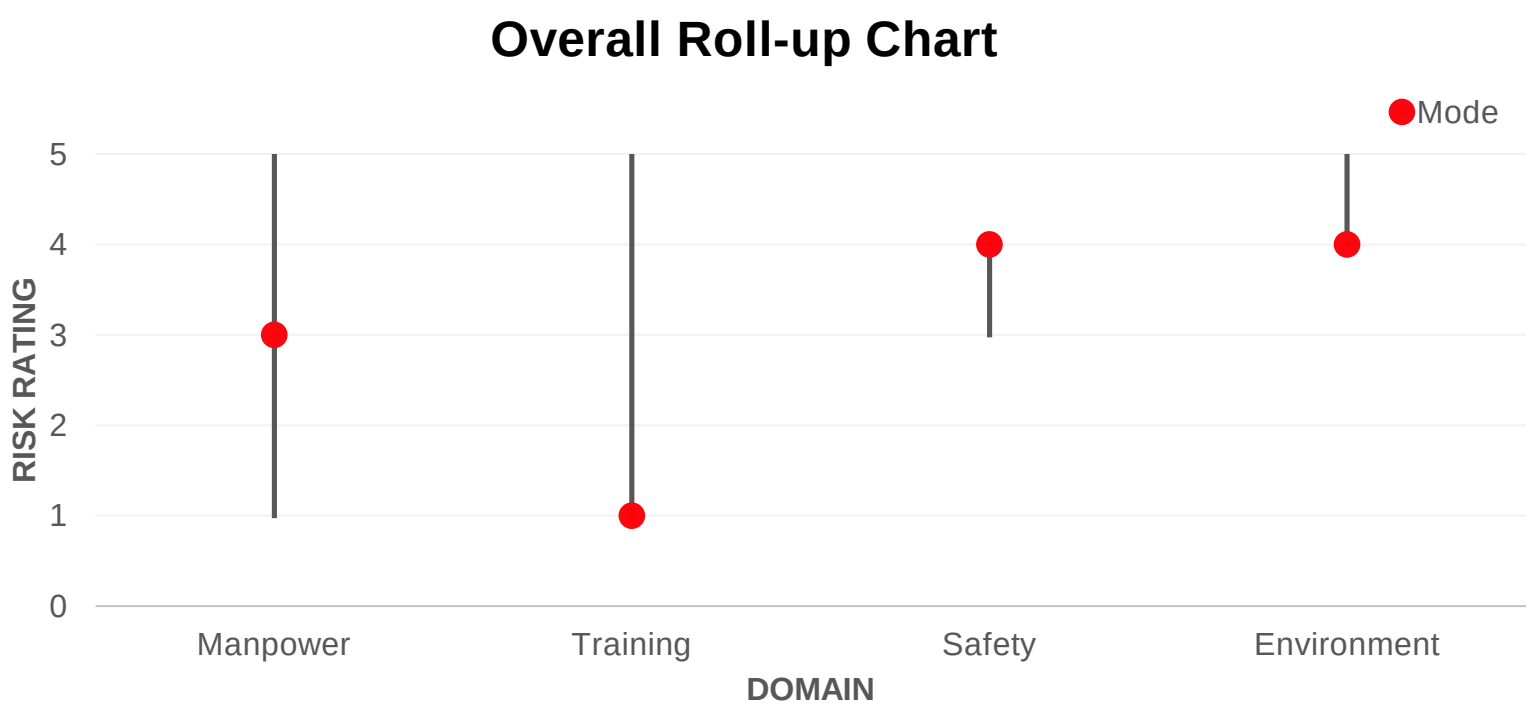
Questions and Risk Assessment Strategy



Likelihood and consequence ratings for each question with a “no” response are translated into an 1 dimensional rating of risk.

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HSI-CRT Reports

Capabilities-Based Assessment

- 12 Risk Matrices
  - 1 Overall Roll-up Risk Matrix
  - 9 HSI Domains
  - 1 Tradeoff
- 1 Roll-up Chart

Analysis of Alternatives

- 12 Risk Matrices
  - 1 Overall Roll-up Risk Matrix
  - 9 HSI Domains
  - 1 General
  - 1 Tradeoff
- 1 Roll-up Chart

Development Planning

- 12 Risk Matrices
  - 1 Overall Roll-up Risk Matrix
  - 9 HSI Domains
  - 1 General
  - 1 Tradeoff
- 1 Roll-up Chart

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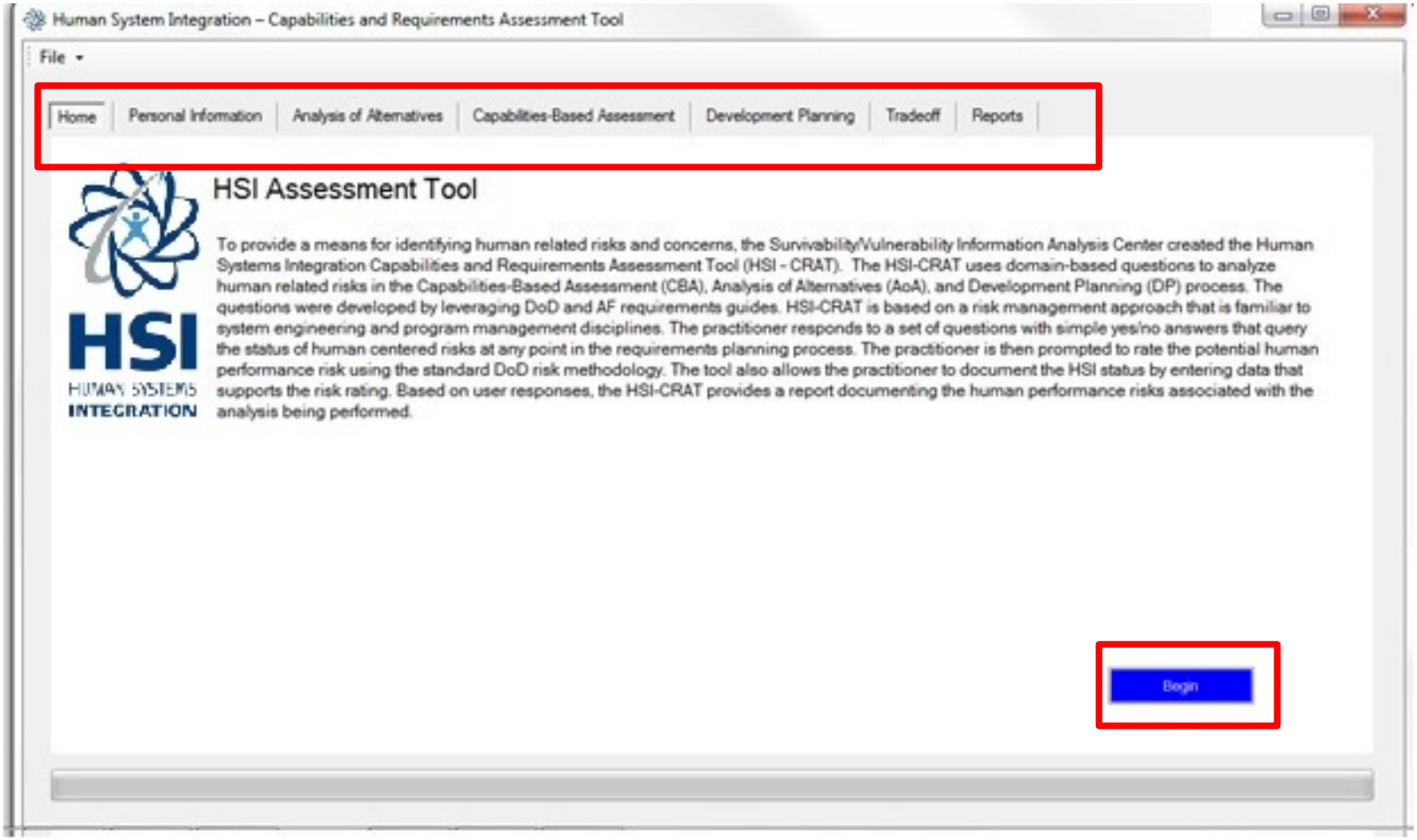
Main Window



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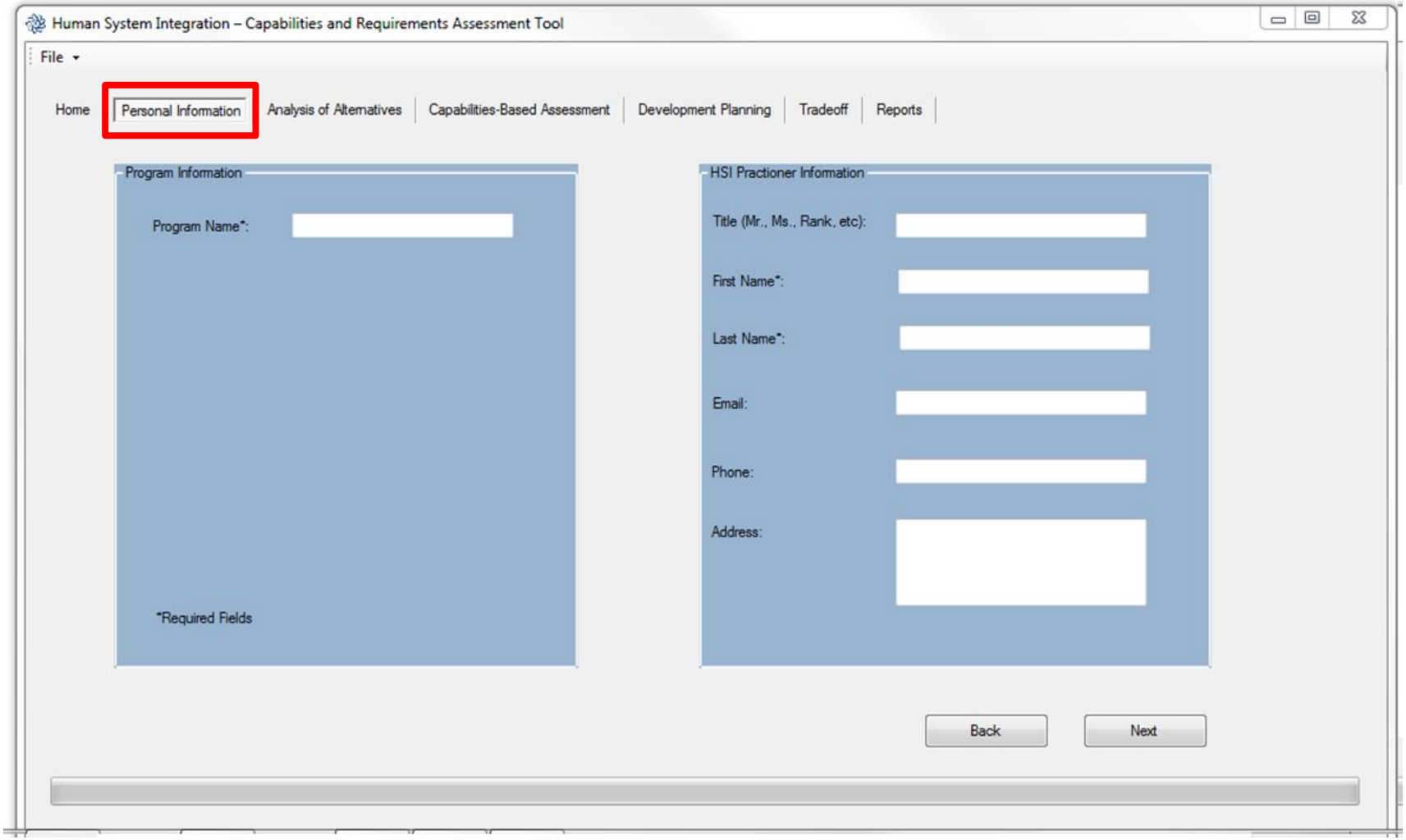
Program/Reviewer Information



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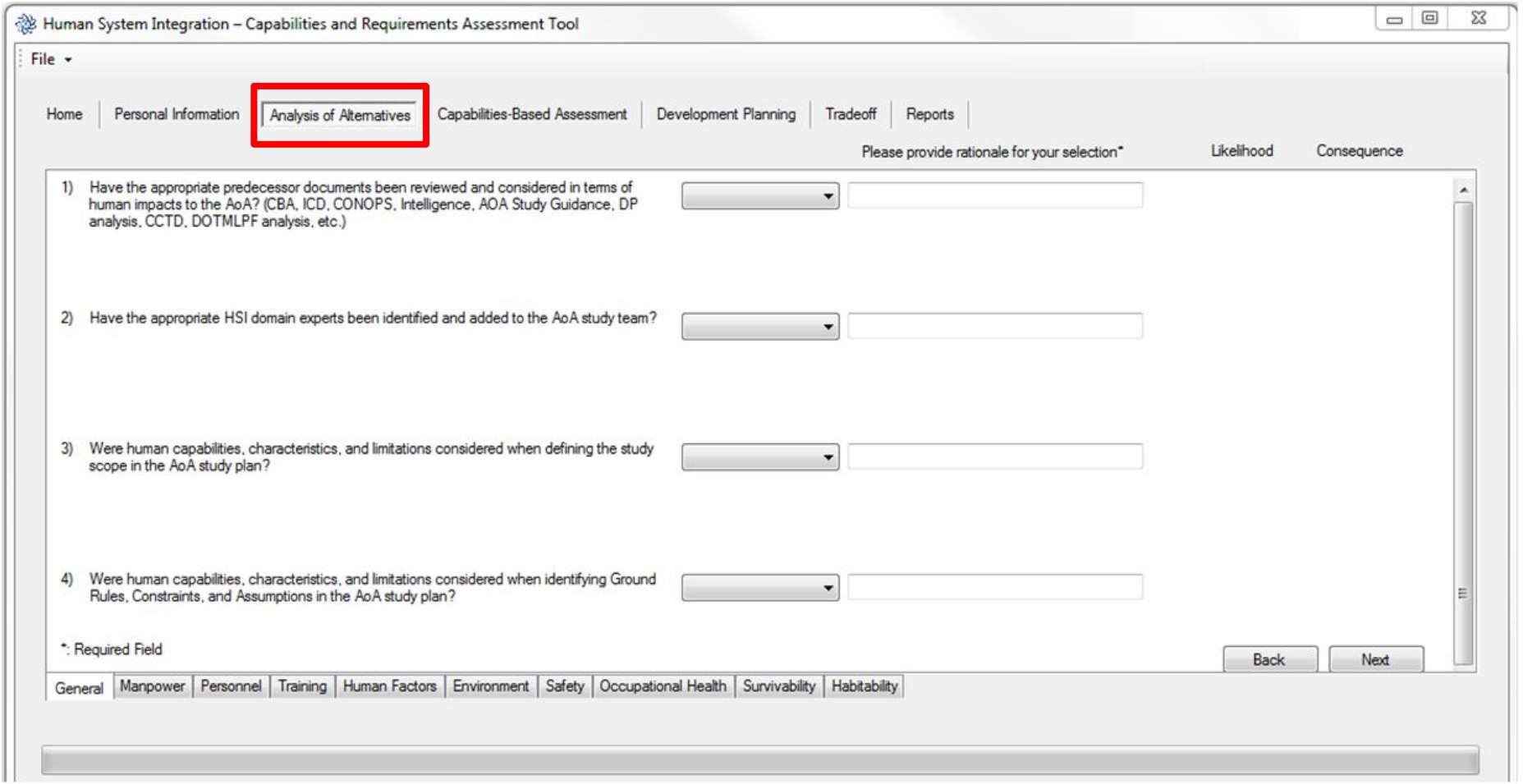
Analysis of Alternatives



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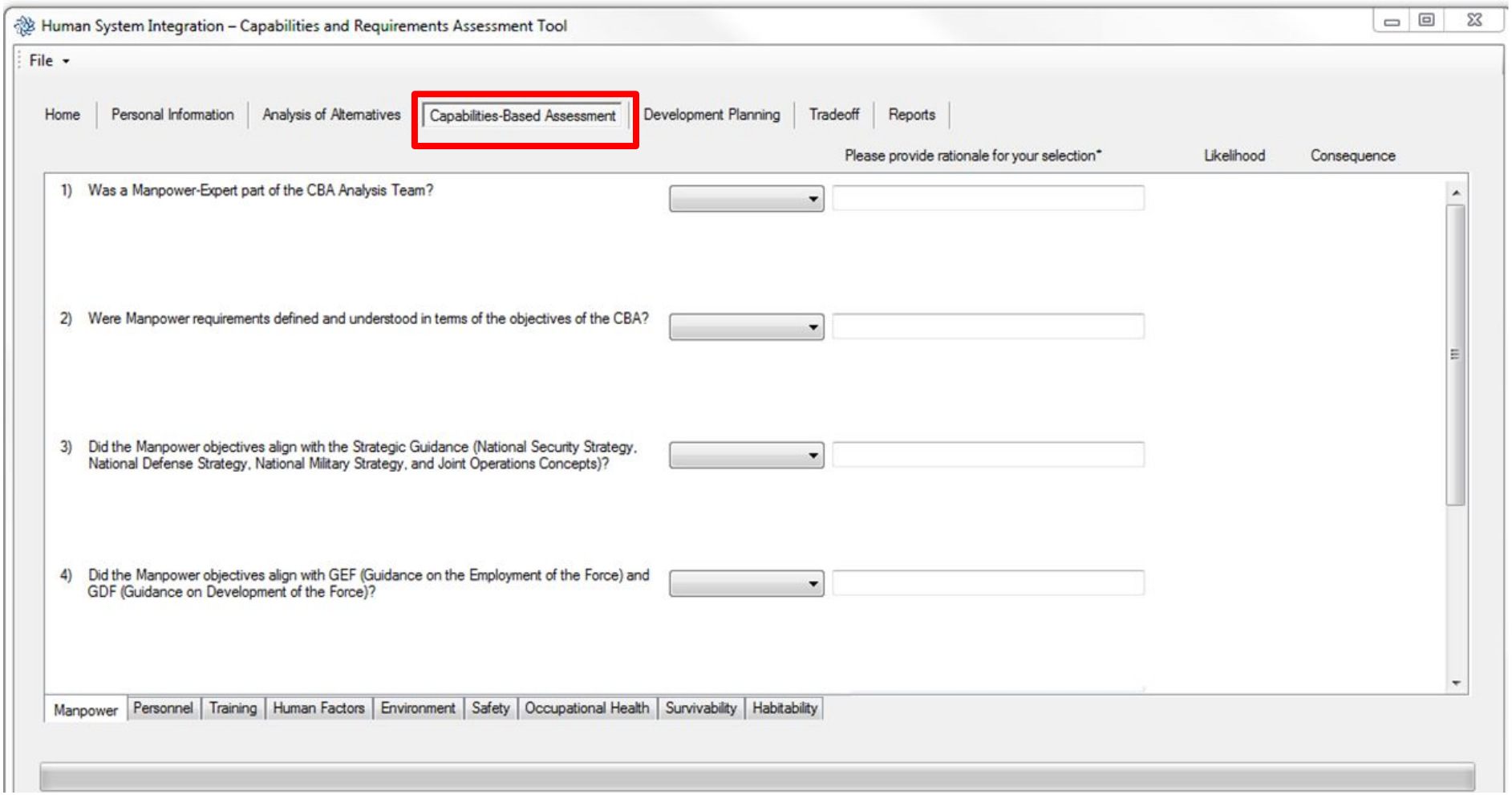
Capabilities-Based Assessment



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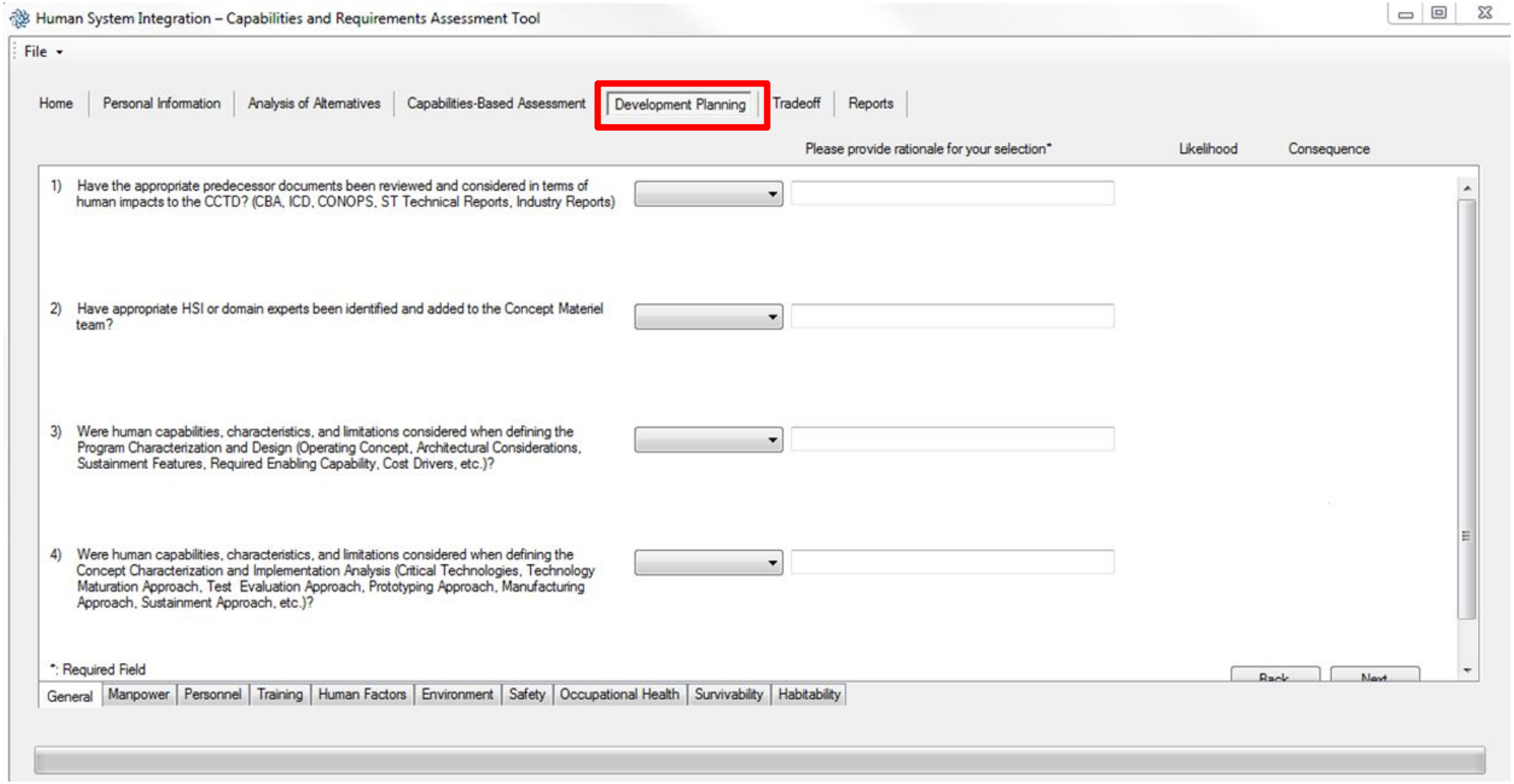
Development Planning



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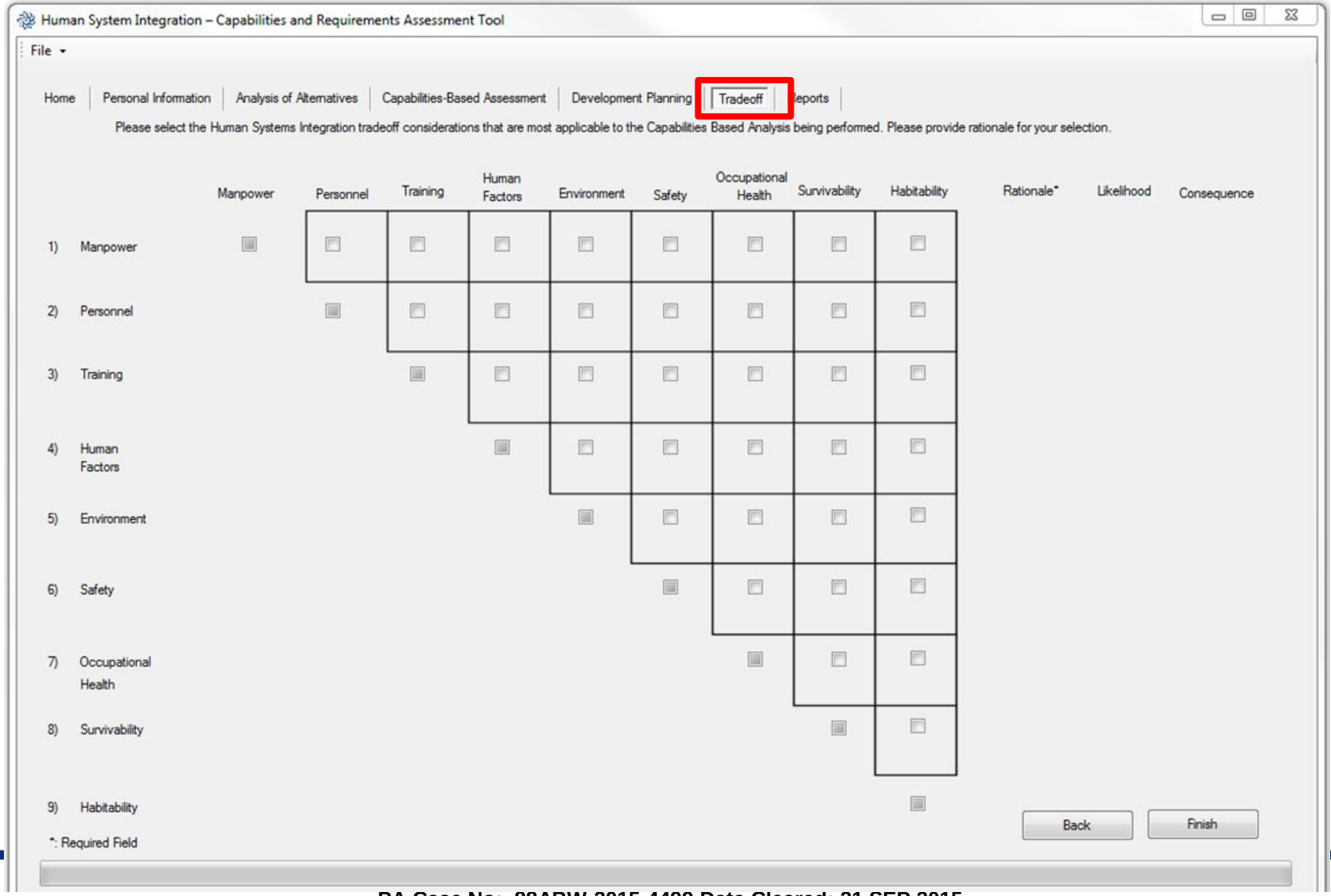
Tradeoff



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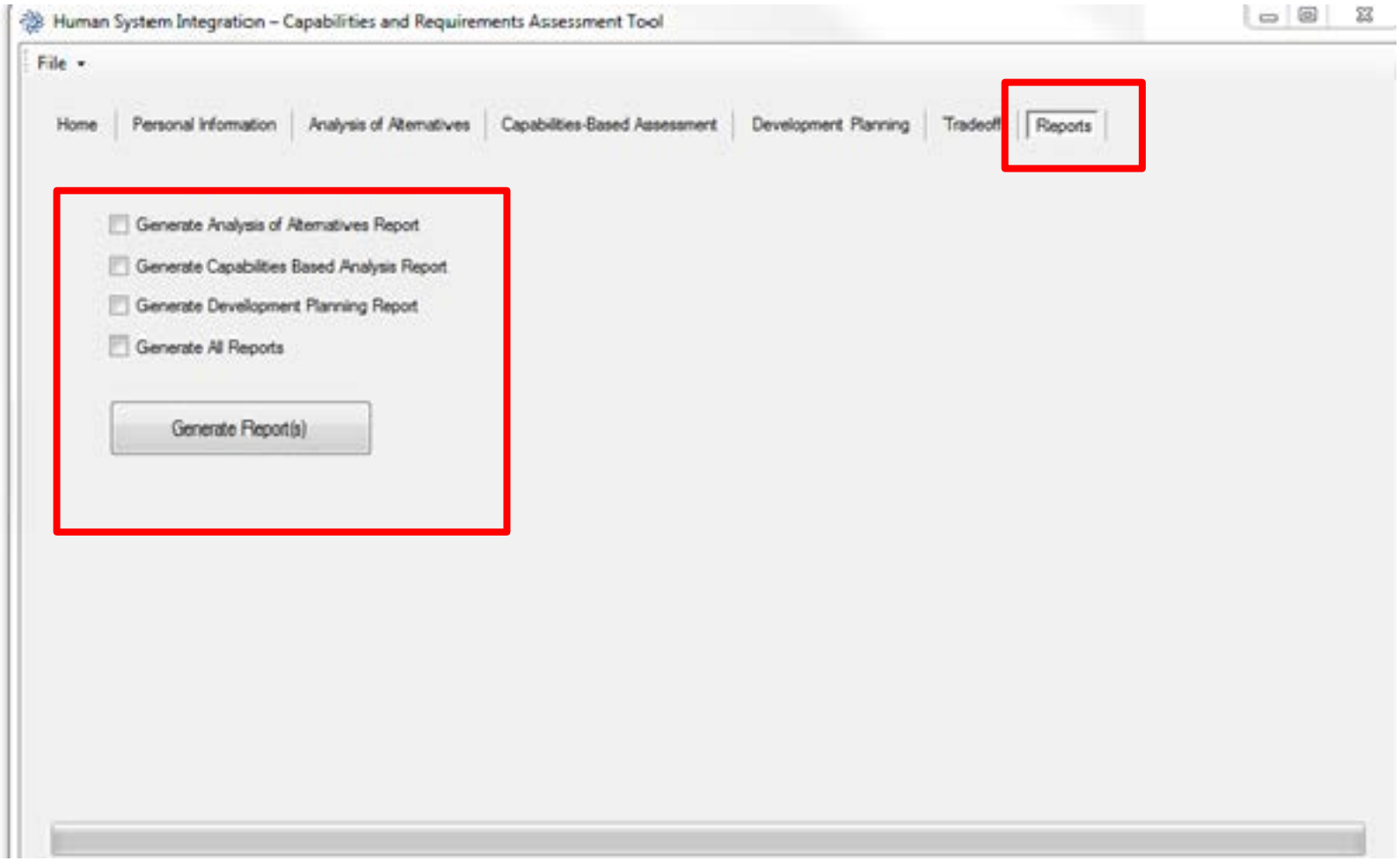
Report Generation



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Report Generation

Overall Risk Matrix

The overall risk matrix, shown in Figure 1, is created by calculating the average values of likelihood and consequence ratings for the following risk matrices.

- Manpower
- Personnel
- Training
- Human Factors
- Environment
- Training
- Safety
- Occupational Health
- Survivability
- Habitability
- Integration

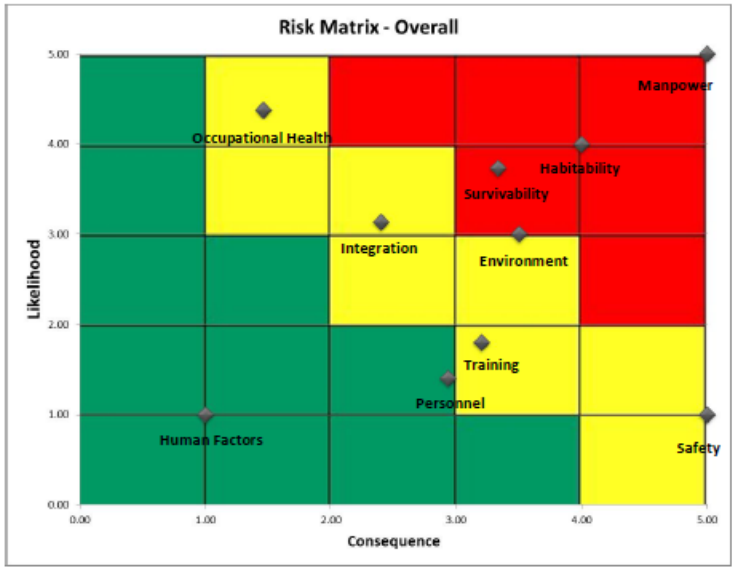

Figure 1: Overall Risk Matrix

Manpower

The Manpower Risk Matrix, shown in Figure 2, is created by plotting the likelihood and consequence rating for each of the manpower questions.

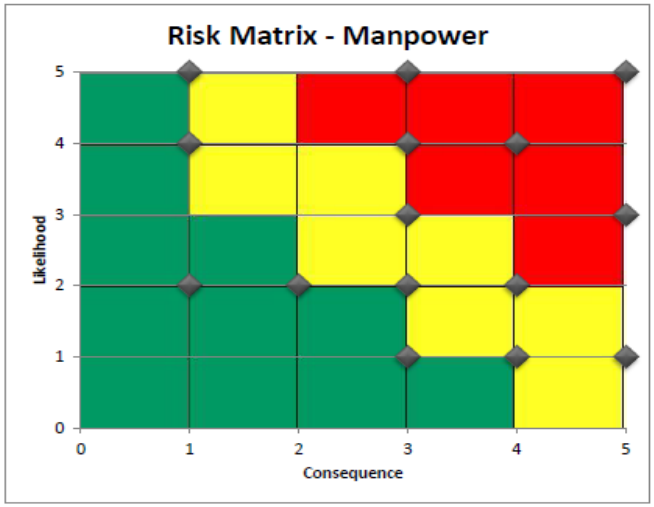

Figure 3: Risk Matrix - Manpower

The user responses to Manpower questions are depicted below.

2.01 Was a Manpower-Expert part of the CBA Analysis Team?

Yes

Please provide rationale for your selection... (The default text should be deleted once the user clicks inside the box).

2.02 Were Manpower requirements defined and understood in terms of the objectives of the CBA?

- No

Likelihood:

Consequence:

Please provide rationale for your selection... (The default text should be deleted once the user clicks inside the box).

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Verification & Validation of Question Sets

Overview

- **Purpose**
  - Review and evaluate the domain-based question sets associated with CBA, AoA, and DP for accuracy, comprehensiveness, completeness, and applicability.
- **Process**
  - Collected background information on Subject Matter Experts (SMEs)
  - Interviewed SMEs
  - Solicited written feedback from SMEs

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Verification & Validation of Question Sets

SME Information Form

- **SME Information Form**
  - Contact Information
  - HSI and HSI Domain Experience
  - Air Force Acquisition Experience
  - CBA , AoA, and DP participation experience

Contact Information

Full Name: _____
Title *First* *Last*

Office Phone: _____

Email _____

Human Systems Integration (HSI) and Domain Experience

How knowledgeable are you in the following?

	Not Knowledgeable	Somewhat Knowledgeable	Knowledgeable	Very Knowledgeable	Years of Experience
Human Systems Integration	☐	☐	☐	☐	
Manpower	☐	☐	☐	☐	
Personnel	☐	☐	☐	☐	
Training	☐	☐	☐	☐	
Human Factors Engineering	☐	☐	☐	☐	
Environment	☐	☐	☐	☐	
Safety	☐	☐	☐	☐	
Occupational Health	☐	☐	☐	☐	
Survivability	☐	☐	☐	☐	
Habitability	☐	☐	☐	☐	

Acquisition Experience

How knowledgeable are you about the following?

	Not Knowledgeable	Somewhat Knowledgeable	Knowledgeable	Very Knowledgeable	Years of Experience
Air Force Acquisition	☐	☐	☐	☐	
Capabilities – Based Assessment	☐	☐	☐	☐	
Analysis of Alternatives	☐	☐	☐	☐	
Concept Characterization and Technical Description	☐	☐	☐	☐	

How many Capabilities – Based Assessments (CBA) have you participated in? _____

How many Analysis of Alternatives (AoA) have you participated in? _____

How many Concept Characterization and Technical Descriptions (CCTD) have you participated in? _____

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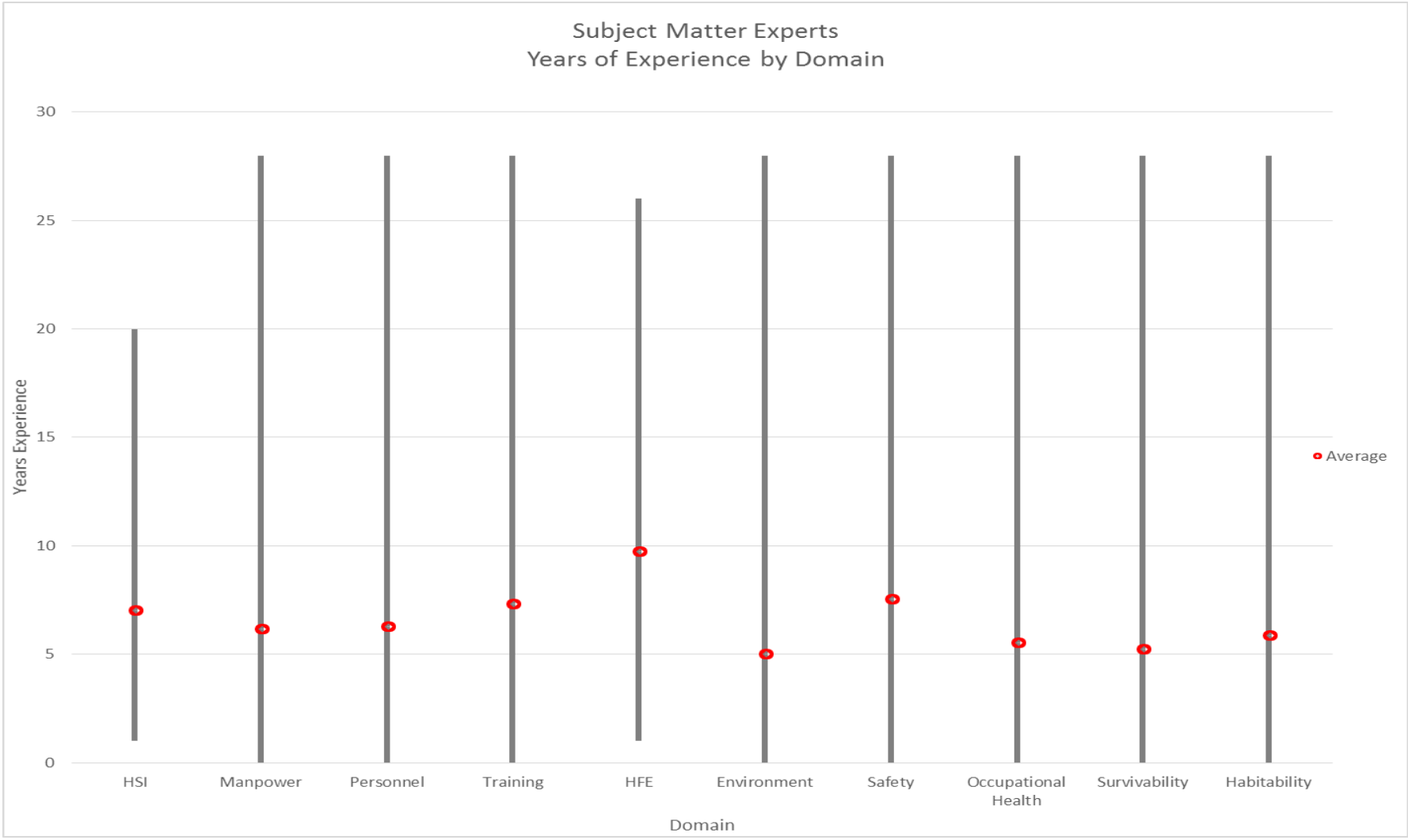
Verification & Validation of Question Sets

SME HSI Experience Overview



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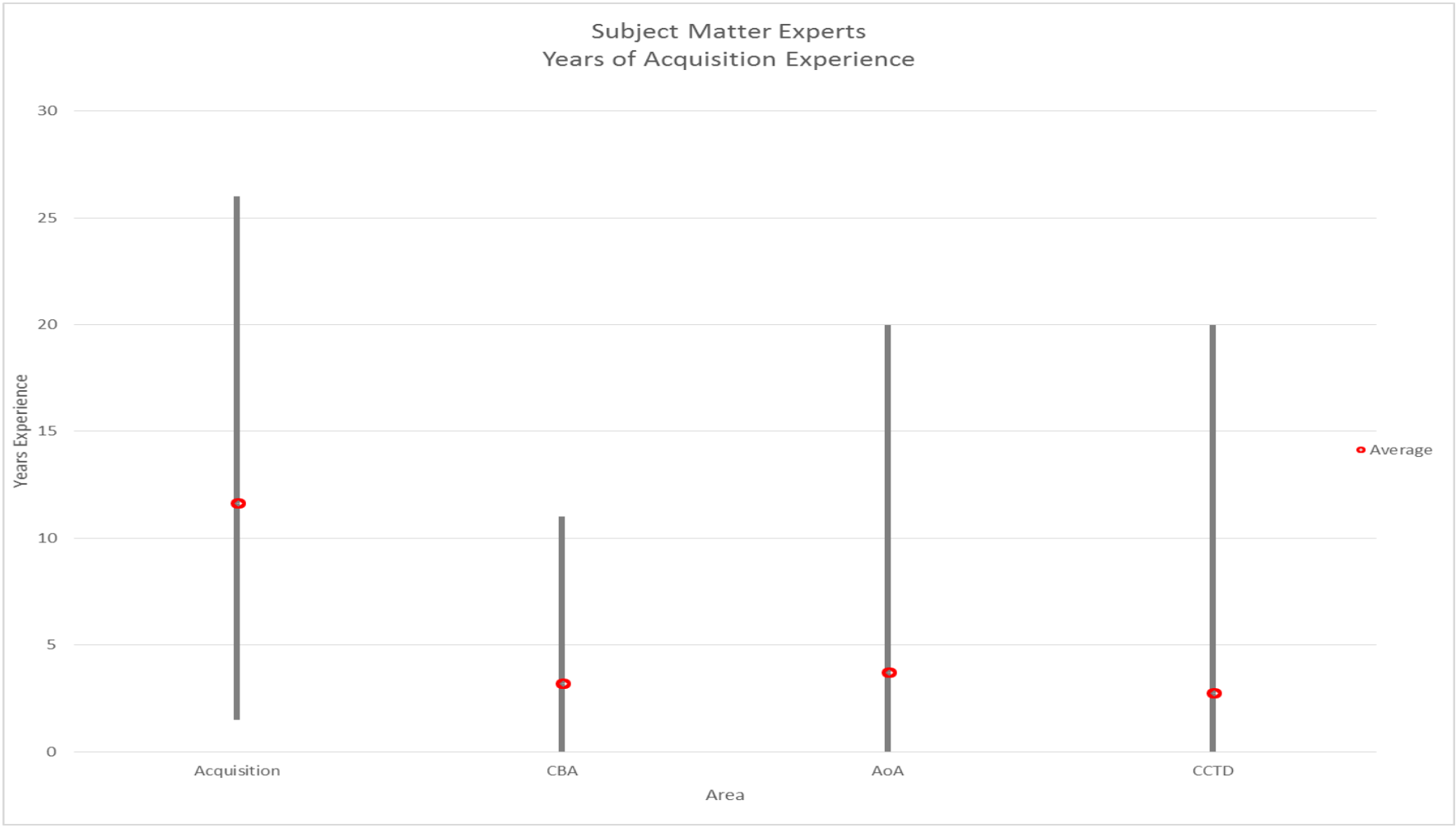
Verification & Validation of Question Sets

SME Acquisition Experience Overview



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HSI-CRT Usability Study
Overview

- **Objectives**
  - Determine design inconsistencies and usability problem areas within the user interface
  - Exercise the application under controlled test conditions with representative users
  - Establish baseline user performance and user satisfaction levels of the interface for future usability evaluations
  - Determine what, if any, features are missing from the tool

- **Participants**
  - 16
  - Included both HSI practitioners and non-HSI practitioners
  - Participant Requirement: PC Proficiency

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HSI-CRT Usability Study
Usability Study Plan

Task	Task Description	Time
Complete User Information Form	The user will be required to complete a User Information Form. The form solicits pertinent contact information such as e-mail and phone number from the user.	5 minutes
HSI-CRT Overview/Training	A member of the research team will provide a brief background of the HSI-CRT as well as outline the basic features of the tool. Additionally, the user will be given a 1-page quick reference sheet that highlights the basic features of the tool.	10 minutes
Scenario 1	The user will be required to complete the following tasks in Scenario 1. • Open the HSI-CRT application • Start a new analysis • Enter Program Information • Enter HSI Practitioner Information • Answer 3 Manpower questions in the Analysis of Alternatives • Answer 3 Personnel questions in the Analysis of Alternatives • Answer 3 Training questions in the Analysis of Alternatives • Select and answer 3 Tradeoff questions in the Analysis of Alternatives • Save current progress • Exit the HSI-CRT application	15 minutes
Scenario 2	The user will be required to complete the following tasks in Scenario 2. • Open the HSI-CRT application • Open an existing CBA analysis from USS2.xlsx from the Desktop • Answer 3 Safety questions in the CBA • Answer 3 Occupational Health questions in the CBA • Select and answer 3 Tradeoff questions in the CBA • Save current progress • Generate HSI-CRT Report • View HSI-CRT Report • Exit the HSI-CRT application	15 minutes
PSSUQ Survey	The user will be required to evaluate the software capabilities of the tool in a quantitative manner by completing the PSSUQ survey.	10 minutes
Wrap-up	A member of the research team will debrief the user.	5 minutes
Total		**60 minutes**

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HSI-CRT Usability Study
Gathering User Feedback

- **Observation**
  - Participant's interaction with the application was monitored by the facilitator/observer seated in the same room.
- **Post-Study System Usability Questionnaire**
  - 19 Questions
    - Overall
    - System Usefulness
    - Informational Quality
    - Interface Quality
  - 7-point scale
    - 1: Strongly Agree
    - 2:Strongly Disagree
- **Open-ended Questions**

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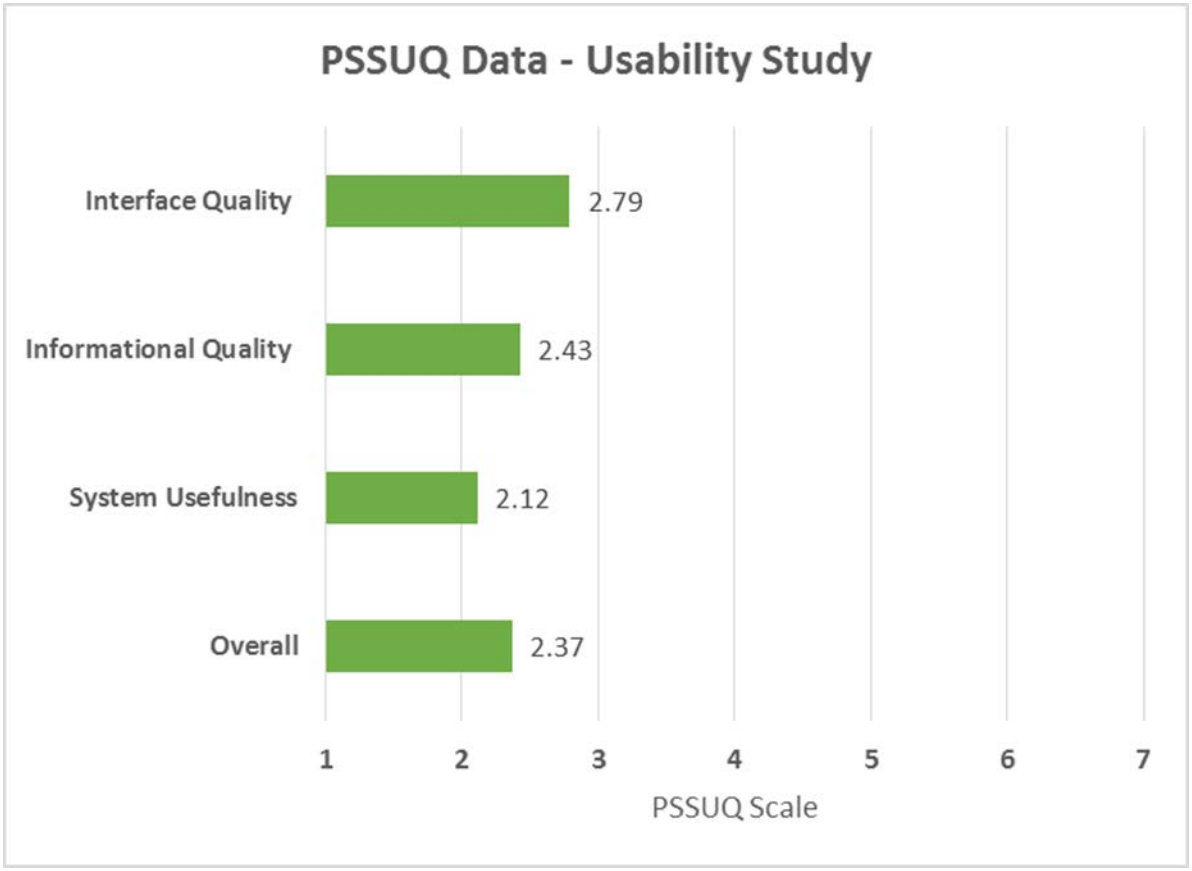
HSI-CRT Usability Study
Results



HSI-CRT Usability Study
Results

- **Some of the changes made as a result of the usability study:**
  - Larger font
  - Larger response box
  - More functions
    - Save As
    - Sort
  - Separate workflows for each document
  - Increased tool responsiveness
  - Change in the location of the tabs
  - Fixed the location of the navigation buttons

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Summary

- **Purpose**
  - Develop an integrated tool for addressing human performance related issues in the CBA, AoA, and DP processes and documents to introduce HSI best practices within the DoD and affiliated acquisition processes
- **HSI-CRT Capabilities**
  - Comprehensive question sets for the requirements documents and processes
  - Integrated approach to assess human related risks to program success
  - Effective and engaging user interface

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Discussion

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Back-up Slides

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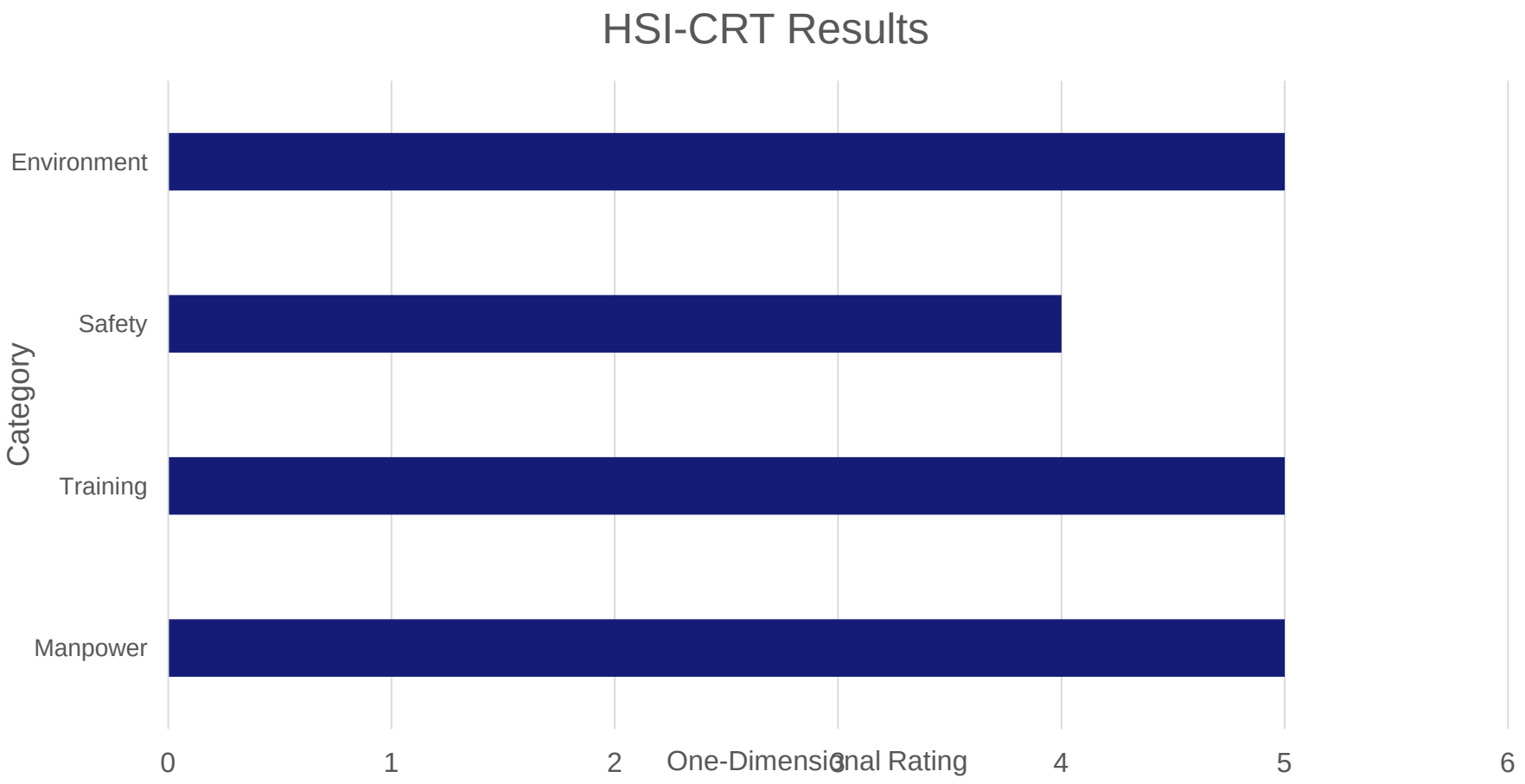
Risk Matrix Roll-up Strategy

Maximum One-Dimensional Rating Bar Chart



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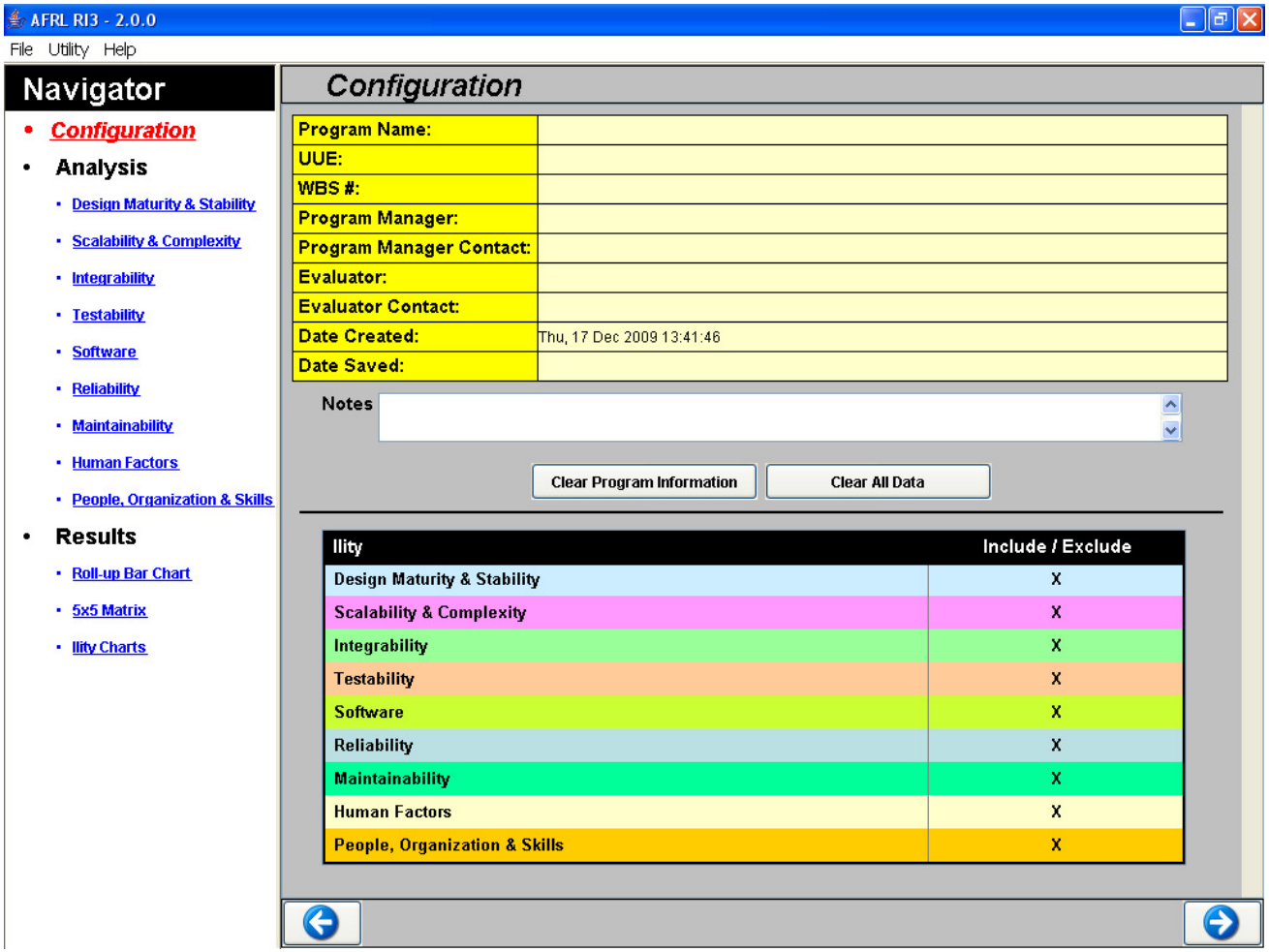
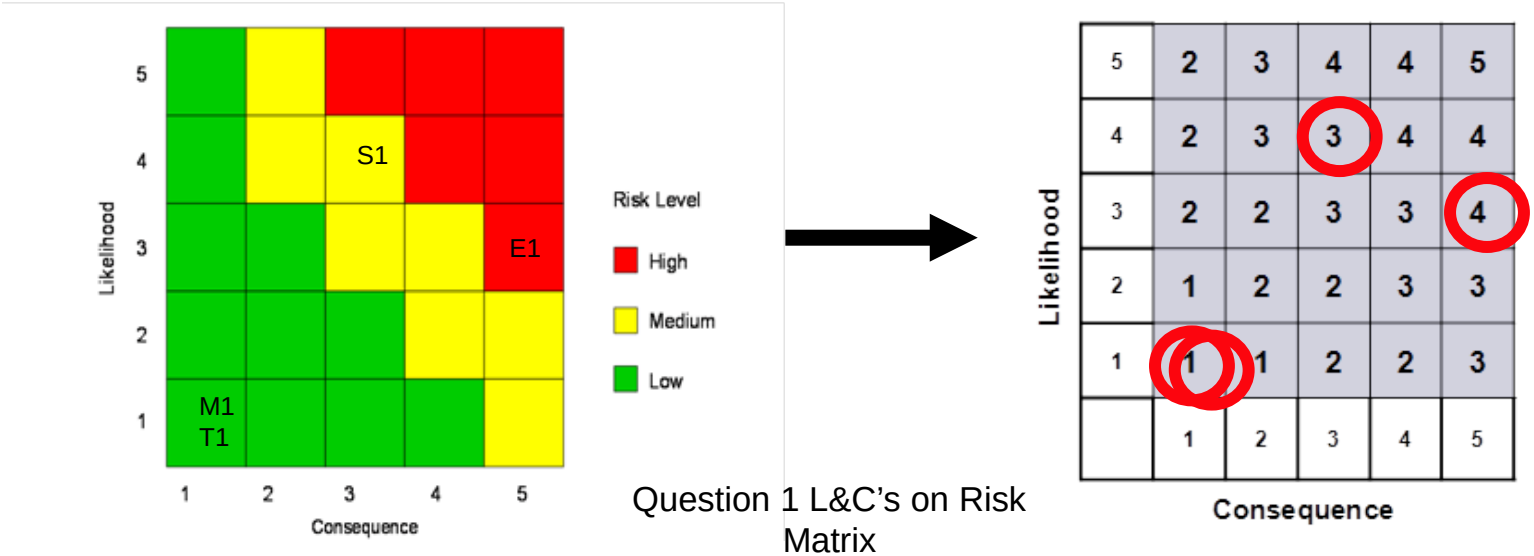
Project Overview – Methods



HSI-CRT Design and Development

Approach to Risk Assessment – An Example

Transform each Likelihood & Consequence Rating to one-dimensional rating



Question 1 L&C's on Risk Matrix

	Manpower		Training		Safety		Environment	
	L	C	L	C	L	C	L	C
Q1	**1**	**1**	**1**	**1**	**4**	**3**	**3**	**5**

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HSI-CRT Design & Development

HSI-CRT User Manual

- **Concise, step-by-step instructions on how to navigate the tool**
  - Home
  - Personal Information
  - Capabilities – Based Assessment
  - Analysis of Alternatives
  - Development Planning
  - HSI Tradeoff Considerations
  - HSI-CRT Report

Report

Human Systems Integration-Capabilities and Requirements Assessment Tool (HSI-CRAT) User Manual

09/24/2014

CONTRACT NUMBER SP0700-03-D-1380, TAT 13-0684, D.O. 522

SURVIAC

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User Interface Design Process