NDIA 11th Annual Systems Engineering Conference

"Improving Process Utilization with Tools"

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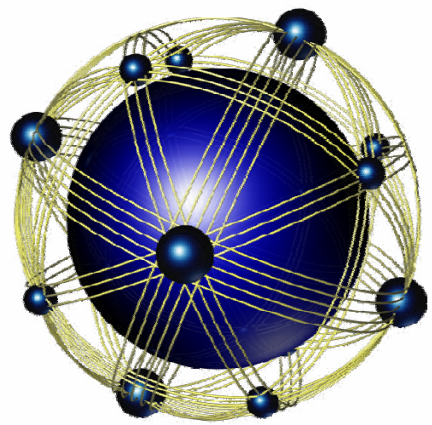
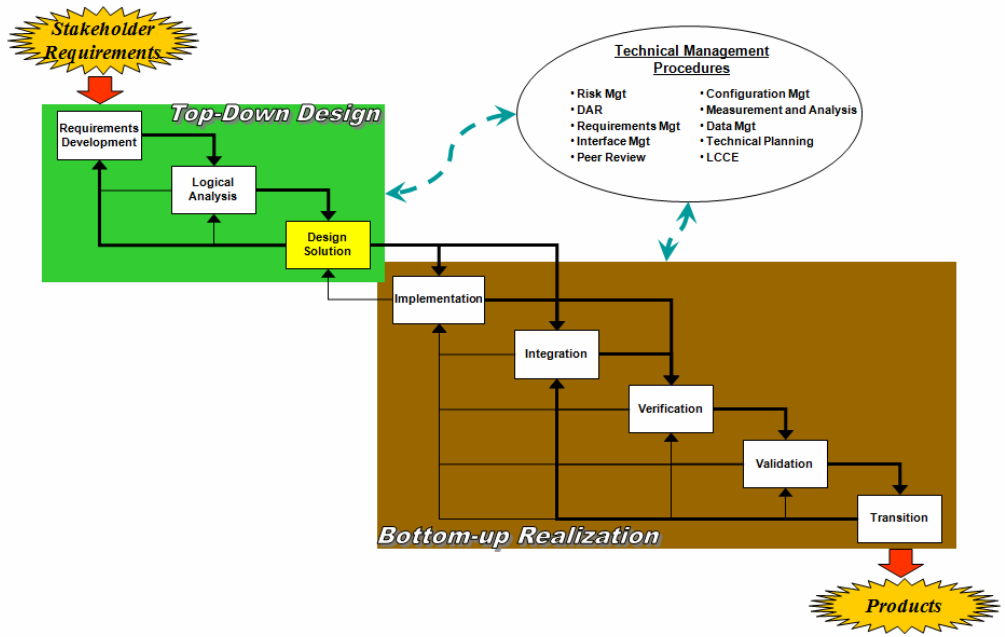


Overview

- Introduction
- The Process Problem
- Tools are a solution
- Examples
- Substantiating Data
- Conclusion

Introduction

The US Army Armament Research Development and Engineering Center (ARDEC) Systems Engineering Directorate (SED) Systems Engineering Infrastructure Division (SEID) has a completely documented Systems Engineering Process.



The Process Problem

All the “best” processes in the world are useless if they are not accepted, understood and implemented by the workforce

Difficulties with Process Acceptance

- **Hard to understand/implement the process**
- **Don’t know what’s available to help process implementation**
- **No common method of implementation**
- **Uncertainty on the part of the user and the advocate on whether implementation is being done correctly.**

Tools are a solution

- **The US Army ARDEC Systems Engineering Directorate (SED) has been investing in its infrastructure via tools that facilitate proper use of its processes**
  - Many are simple Excel/Access tools that were developed in <100 man hours
- **Tools that:**
  - Guide the user through the process and document the results of each step (DAR, Peer Review, Roadmap)
  - Evaluate a project's compliance to process(es) (PP Eval)
  - Guide the user towards additional resources to assist them (PP Eval, IPPD, PAL)
  - Get the user started with some instruction (Requirements Management Plan Template, System Spec Template)
  - Provide the user with examples to choose from (Technical Engineering Database (TED), Example Project Plans)
- **Feedback has shown that they improve process utilization**

ARDEC SE Roadmap

The SE Roadmap Tool encompasses **17 ARDEC SE process areas** that describe key aspects of SE tasks covered by projects during the complete product lifecycle

Project Planning

Requirements Development

Logical Analysis

Design Solution

Implementation

Integration

Verification

Validation

Transition

Decision Analysis and Resolution (DAR)

Technical Assessment

Requirements Management

Risk Management

Data Management

Configuration Management

Interface Management

Peer Review

SE Roadmap Implementation

Roadmap provides basis for technical planning, feeds the Project Plan/Schedule, allows technical assessment versus planned activities and supports multiple reporting needs

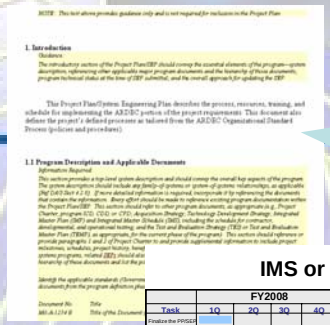
1 2 3 6

4

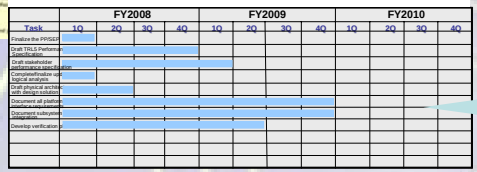
5

Roadmap SE Level	1	2	3	End State (Highest Level to be Achieved)	Planned Accomplishments (SE Accomplishments to get to Next Level)	Schedule (Timeframe)	Product (Associated Product(s))	Status
SE Processes								
1.0 Project Planning	Tailor Template, Prepare Draft PP for Initial Review, Submit PP to PI	Project Plan Approved	Project Plan Maintenance	3	Finalize the PP/SEP for approval	March, 2008	PP/SEP	~~~
2.0 Requirements Development (ARDEC-200)	Identify Stakeholders	Elicit Stakeholder Requirements	Get Stakeholder Commitment	3	Support development of TRL5 requirements	commence 1QFY09	Draft stakeholder performance specification	~~~
	Analyze Scope of Technical Problem	Define TRL5 Technical Requirements	Define TR6 Technical Requirement	3	Support translation of stakeholder requirements	4QFY08	Draft TRL5 performance specification	~~~
3.0 L... Ana... (ARDEC-205)	Document system functions and logical alternative	Each, Allocate Technical Requirements to Logical Analysis Models(s)	Support the resolution of derived technical requirement conflicts	3	Complete/finalize updated logical analysis	March, 2008	Logical description. States and modes diagrams as defined by the IPT	~~~
4.0 Design Solution (ARDEC-206)	Document alternative design solutions as researched by the IPT	Support IPT analysis and selection of the preferred solution	Generate Full Design Solution Description and Baseline	3	Support design solution process and ensure solutions are traceable to technical requirements	June, 2008	Physical architecture with design solution	~~~
5.0 Implementation (ARDEC-208)	Document what components will be made, reused or bought	Identify Interfaces, Plan for Enabling Products	Acquire all Components	3	Document all platform interface requirements	4QFY09	Platform interface requirements per product baseline	~~~
6.0 Integration (ARDEC-209)	Confirm validation of received products	Prepare for assembly & integration	Document lessons learned	3	Document subsystem integration	4QFY09	Draft Integration plan/procedure	~~~
7.0 Verification (ARDEC-210)	Prepare to conduct TRL5	Perform Verification	Analyze Verification Results	3	Develop verification plan	2QFY09	Draft verification plan/procedure	~~~

Project Plan



IMS or Project Schedule



Project Plan – SE portion of project plan describes how project will achieve specified SE levels for each process area

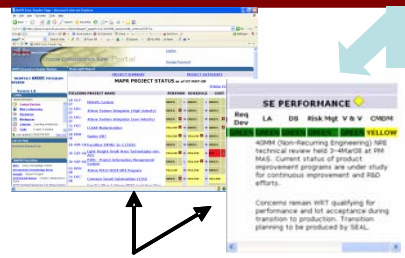
Project Schedule reflects SE activities and events needed to develop technology/product and satisfy roadmap transition criteria

Roadmap Implementation Guide:

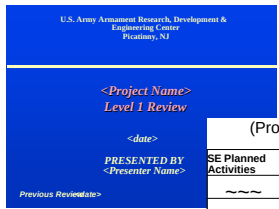
Planning	1.	Coordinate with APO/IPT to baseline current SE activities
Planning	2.	Based on the project objectives, define with APO/IPT the required SE End State (use SE procedures to assist with tailoring as appropriate)
Planning	3.	Work with APO/IPT to determine what SE Tasks will satisfy transition criteria to achieve next SE level & complete Roadmap accordingly
Planning	4.	Develop or update Project Plan/Schedule using Roadmap input to complete SE sections of plan
Tracking	5.	Verify that IMS/Project Schedule reflects accomplishments, schedule and products contained in Roadmap
Assessment	6.	Assess Project's performance against Roadmap details and provide status in the Roadmap Column title "status". Describe any corrective actions as required.
Reporting	7.	Use tech assessment from Roadmap to address reporting requirements (MAPR, Level 1, Level 2, Level 3 Briefings, etc.)

Reporting Processes

7



MAPR format includes SE Status (tech assessment), project rating, and corrective action plan (if needed)



Level 1 Briefing summarizes SE status of project

(Project Name) SE Status

SEL: (Name)

SE Planned Activities	Time frame	Associated Product(s)	Status
~~	~~	~~~	~~~
~~	~~	~~~	~~~
~~	~~	~~~	~~~
~~	~~	~~~	~~~

SE Roadmap is the Linchpin that Ensures Effective Technical Planning and Technical Assessment Activities on Projects

Project Plan Evaluation Tool

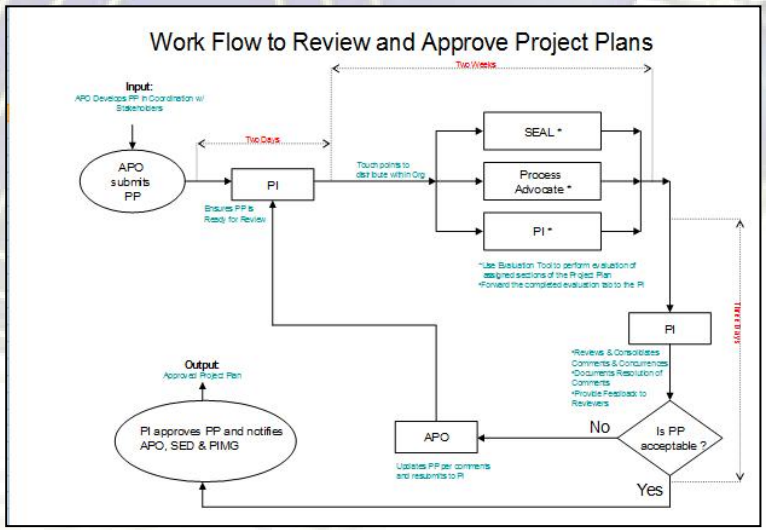
- **The Project Plan (PP) is a key piece of the ARDEC Project Management process**
  - Originally developed for Project Plan (PP) evaluators to perform an assessment of a PP which lead to PP approval and project funding
  - Quickly became a key instructional document provided to projects who were writing/updating their PP
  - Also used to capture the Ownership Matrix for every PP section (who the SME is for each PP section). This provides key contact for further assistance
  - Process Flow
  - Automatically tailors the Evaluation Criteria based on project details that are used to “seed” the tool. (project scenario, phase etc.)

Project Plan Evaluation Tool

Project Name:	EXAMPLE Project
PP Version #:	<PP Version Number>
Project Scenario:	<PP Scenario>
Project Phase:	Technology Development
APO Name:	<APO Name>

Date Received:	<Date Received>
PI Name:	<Name of PI>
PIO Evaluator Name:	<Enter PI Evaluator Name Here>
SEAL Name:	<Enter SEAL Name Here>
Process Advocate Name:	<Enter Name Here>

The Questions are tailored based on the Project Details above



Process Flow

15 System Engineering Process	1	0
1. Does the PP describe the overall SE process to be used on the project and the basis for selection (e.g., commercial standard, organizational process, etc.), including the purpose and objectives of the process?	G	
2. Does the PP describe the technical authority responsible for implementation of the SE process?	R	
15.1 Requirement Development	**0**	**1**
1. Does the PP specify the approach and methods used to define the performance and functional requirements (including all product and component functional requirements, performance requirements, interface requirements, and other detailed requirements)?		Y

Each Project Plan section is evaluated

PP Sect. #	Project Plan Section	PIMG	SED	PIO
19	Interface Management		Rob Bernard	
20	Process Assurance Plan	Process Advocate		
21	Configuration Management		Paula Baselinesa-Versi	
22	Data Management		Petro Librariano	
23	Project Deliverables/Work Products			Project Integrator
24	Simulation Support Planning		Modello Simulato Jr.	
25	Risk Management Plan			Project Integrator

Ownership Matrix details SMEs for each section

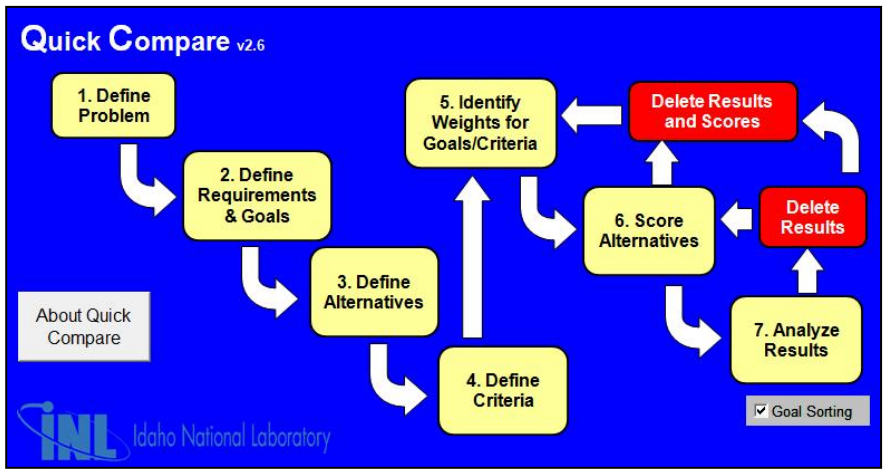
Feedback
We welcome feedback on the Evaluation Criteria and this Evaluation Tool itself. Please use the link below to send feedback to Frank J. Salvatore (SED), Humisar Sianipar (PIO) and Dan Crowley (PIMG).
Click to Send Feedback

Integrated Feedback functionality

Decision Analysis and Resolution

- **Process is nested within the tool**
  - Each Process Step has a corresponding section of the tool.
- **Use of the tool provides a project with "self documenting" input data and results**
- **Provides the user with some standard graphical forms of output that assist with both making the decision and capturing its rationale**
- **Use of the tool follows the DAR Procedure**

Decision Analysis and Resolution



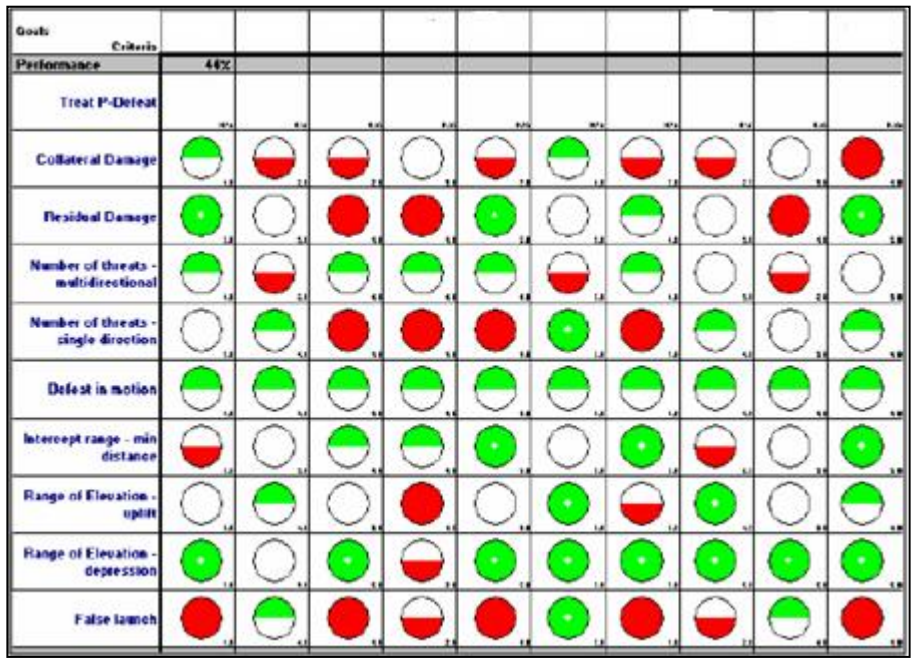
Follow the process steps in the tool

Goal Number	Goal Name	Goal Weight Factor	Normalized Weight Factor	Criteria Name	Criteria Weight (within each goal)
1	Reduce Cost	9	0.563	Cost	10
2	Meet Schedule	4	0.250	Schedule	2
				Safety	3
3	Reduce Risk	3	0.188	startup risk	9

Identify and Weight Goals + Criteria

	Criteria Weight	Alt 1	Alt 2	Alt 3	Alt 4
Cost	0.563	30000	50000	25000	80000
Schedule	0.100	5	3	1	7
Safety	0.150	Good	Fair	Bad	Great
Startup Risk	0.188	4	3	9	1

Raw Input for each Alternative



Utility applies to the Raw Input to Score the Alternatives against the Criteria

Integrated Process & Product Development Tool

- **database of available resources (procedures, tools, templates etc.)**
- **earch based on different “languages” (DOD lifecycle, Six Sigma, SED SE Process…), and the sub-steps within that language**

Integrated Processes and Tools

Help You Find the Best Processes and Tools to Support IPPD

Use Drop Down Lists to Generate Report

1) Select Process/Method

2) Select Procedure/Step

3) Select Resource Type (optional)

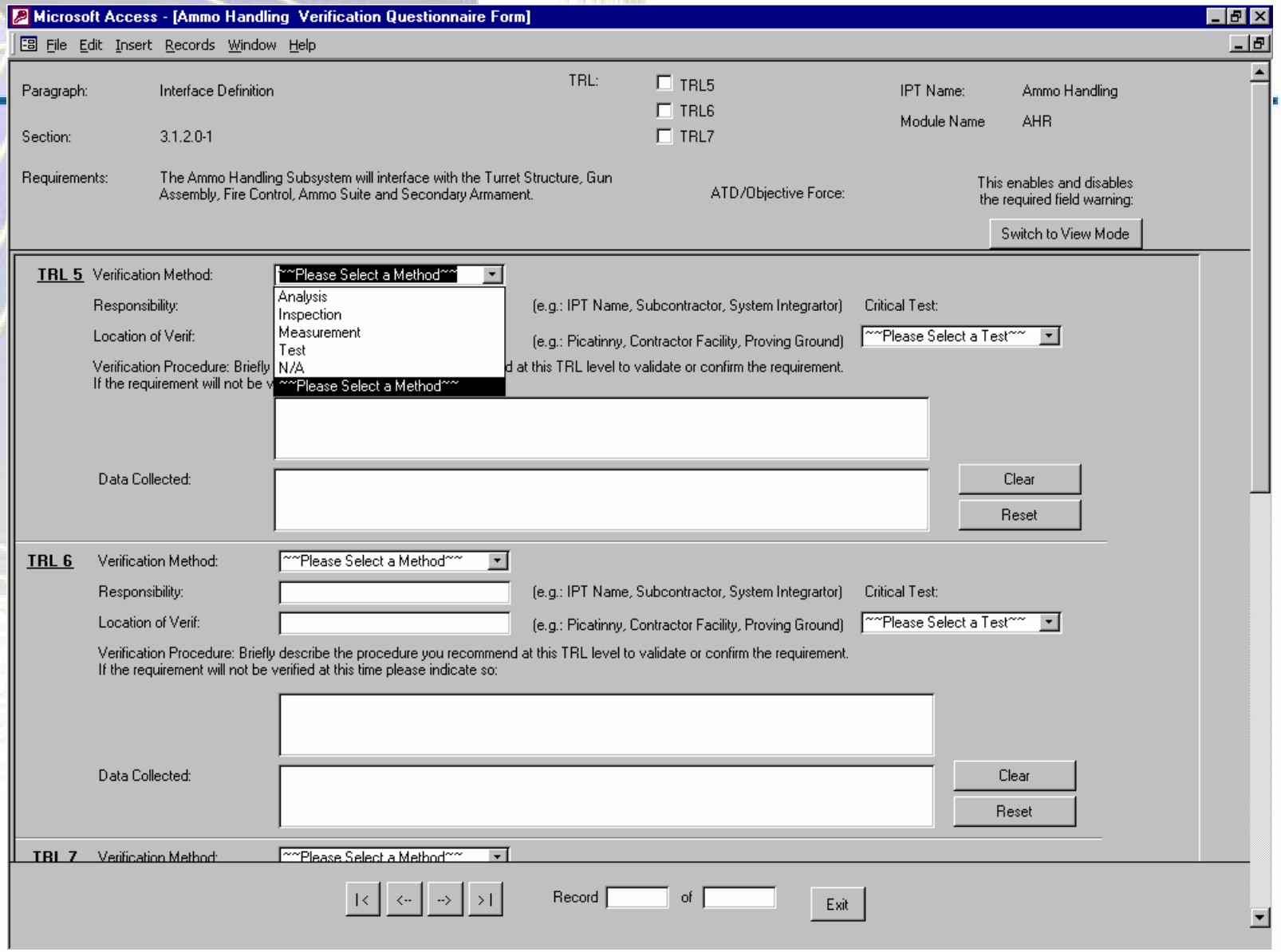
Process/Method	Procedure/Step	Resource Type
Systems Engineering Process	Technical Planning	Tool

Resource	Type	User	Purpose	Reference	Reference Location	POC	Applies to
Work Breakdown Structure (WBS)	Tool	APO	To better define and organize the total scope of a project, using a hierarchical tree structure	Para. 7.1 Phase A Project Initiation Step A4 WBS Template 1 Oct 2007	ARDEC 101 Project Management Procedure	PIO	Project Planning, Technical Planning,
Earned Value Management (EVM)	Tool	APO	To better ensure the total integration of cost, schedule, and work scope aspects of the contract.			PIO	Project Planning, Technical Planning, Risk Management,
Project Plan Evaluation Tool	Tool	ALL	To better evaluate the quality of the Project Plan		Project Plan Evaluation Tool 21 Sept 2007	PIO SED	Project Planning, Technical Planning,

Report provides tailored list of Resources

Verification Tool

- Use Interview
- Use Questionnaires
- Include Stakeholders Early and Often.
- Have Stakeholders Peer Review Requirements
- Use a JCCB


Microsoft Access - [Ammo Handling Verification Questionnaire Form]
File Edit Insert Records Window Help
Paragraph: Interface Definition
TRL: TRL5 TRL6 TRL7
IPT Name: Ammo Handling
Module Name AHR
Section: 3.1.2.0-1
Requirements: The Ammo Handling Subsystem will interface with the Turret Structure, Gun Assembly, Fire Control, Ammo Suite and Secondary Armament.
ATD/Objective Force:
This enables and disables the required field warning:
Switch to View Mode
TRL 5 Verification Method: ~~Please Select a Method~~
Analysis
Inspection
Measurement
Test
N/A
~~Please Select a Method~~
Responsibility:
(e.g.: IPT Name, Subcontractor, System Integrartor)
Critical Test:
Location of Verif:
(e.g.: Picatinny, Contractor Facility, Proving Ground)
~~Please Select a Test~~
Verification Procedure: Briefly
d at this TRL level to validate or confirm the requirement.
If the requirement will not be v
Data Collected:
Clear
Reset
TRL 6 Verification Method: ~~Please Select a Method~~
Responsibility:
(e.g.: IPT Name, Subcontractor, System Integrartor)
Critical Test:
Location of Verif:
(e.g.: Picatinny, Contractor Facility, Proving Ground)
~~Please Select a Test~~
Verification Procedure: Briefly describe the procedure you recommend at this TRL level to validate or confirm the requirement.
If the requirement will not be verified at this time please indicate so:
Data Collected:
Clear
Reset
TRL 7 Verification Method: ~~Please Select a Method~~
|<
<--
-->
>|
Record
of
Exit

Templates

- **isting of some Templates:**
  - Project Plan Template
  - Requirements Management Plan Template
  - System Specification Template
  - Interface Control Document Template
  - Etc….

Substantiating Data

- his year we are working on metrics and measures that will provide greater insights into what is and isn't working

- here is a whole suite of metrics and measurement tools that have been developed.

What makes a “good” tool?

- **onfiguration Management built into the tool for Change History, versioning etc.**
- **nstructions on how to use the tool**
  - Instruction sheet, pop-up comments
- **rocess Flow**
- **eedback Form**
- **ie the tool into the process they are seeking to implement (language, steps etc.)**

Conclusion

- ools are common focal points for discussion.
- anagement expects them to be used
- e are starting to capture metrics to help guide future changes and to build a case to develop and make improvements to tools.

Questions?