Intel's TRIZ Expert Field Guide

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Content

- Intel and TRIZ
- Why does Intel need a guide?
- What does the guide contain?
- Other benefits of the guide
- General benefits of a guide
- How is the guide used at Intel?
- Summary of a Field Guide's Benefits
- References

Intel and TRIZ

- Was looking for structured methodology to support innovation
- Began incorporating TRIZ in 2003
- Realized advantage of the applied science of innovation
- Increased our TRIZ trained employed by 10X over the past 3 years:
  - 80% Level 1
  - 10% Level 2
  - 10% Level 3
- Where TRIZ efforts are targeted:
  - 95% used for manufacturing process improvement
  - Internal business process improvement
  - Product design application

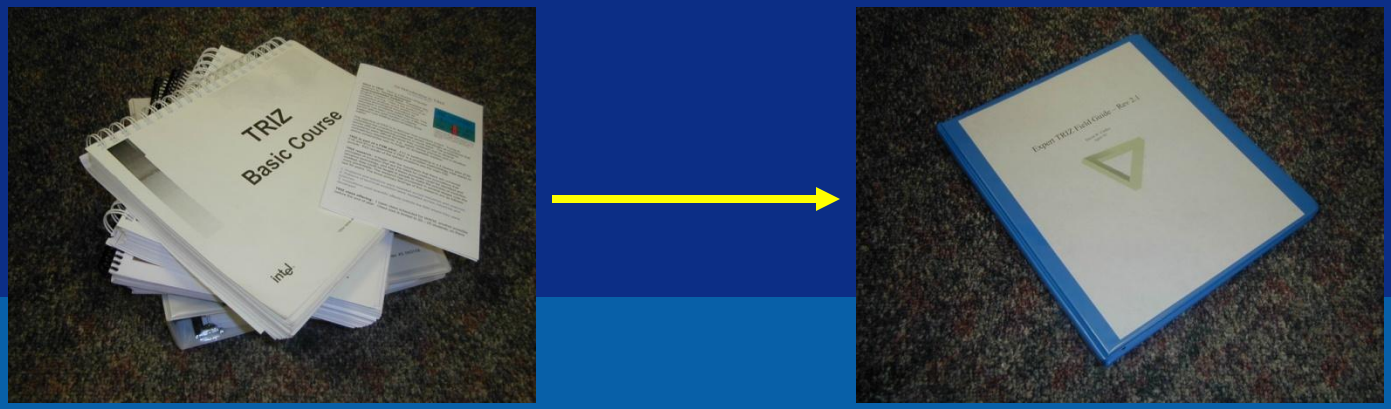
Why Does Intel Need a Guide?

Intel is a proponent of standardization and repeatability between areas, organizations, and personnel

- It is important to the expansion of the TRIZ program within Intel that it be supported by a standardized manual

Why a standardized manual?

- Advanced models and array of concepts makes mastery challenging – guide simplifies the process of learning/execution
- Helps users understand the interrelationship of concepts and tools – concept relationships are documented in the guide
- Practitioner can refresh less frequently used concepts
- Concentrates vast amount of material
  - 1500+ pages of training material organized into to 80+ pages of reference manual



What Does the Guide Contain?

- Primarily based on MATRIZ Level 3 course material
- Personal observations and realizations of concept interrelationships
- Level 1 and 2 concepts where necessary in bolstering Level 3 concepts

Doc. Sec.	Subject	Doc. Sec.	Subject
1	TRIZ Definitions and Characterizations	15	*proprietary material*
2	Elementary TRIZ Roadmap	16	*proprietary material*
3	Problem Model Types	17	*proprietary material*
4	Contradiction Modeling	18	*proprietary material*
5	Su-Field Modeling	19	*proprietary material*
6	Functional Modeling	20-30	Trends of Engineering System Evolution
7	*proprietary material*	31	*proprietary material*
8	Solution Model Types and Their Inter-relationship	32	Forecasting
9	Standard Inventive Solutions	33	*proprietary material*
10	Altshuller's Matrix Overview	34	*proprietary material*
11	*proprietary material*	35	*proprietary material*
12	*proprietary material*	36	*proprietary material*
13	*proprietary material*	37	Appendix - AIST, 39 Parameters, 40 Principals
14	ARIZ (Algorithm for Inventive Problem Solving)	38	Glossary

What Does the Guide Contain?

- Text based*:
  - Tool descriptions and discussions
  - Process Methodologies
  - Algorithms

For Example:

5 Classes of Standard Solutions:

1.) Synthesis & Destruction
2.) Increase Su-field / Increase Effectiveness
3.) Transition to the Super System
4.) Measurement and Detection
5.) How to use recommendations from 1-4.

Class 1: Constructing or destroying the Su-field model if it is incomplete or harmful - Class 1 contains solutions dedicated to building and destroying Su-Field Models, and includes several rules for either creating required interactions or eliminating undesired interactions, depending on the restrictions that apply.

2 sub-classes w/ 13 Standard Inventive Solutions

What Does the Guide Contain?

- Graphics based**:
  - Examples
  - Charts/Tables
  - Diagrams

For Example:

Model of Problem	Tool	Model of Solution
Engineering Contradiction	Altshuller's Matrix	Inventive Principles
Su-Field	76 Standard Solutions	Specific Standard Inventive Solution
Physical Contradiction	Separation, Satisfaction, Bypass Algorithms	Inventive Principles
Physical Contradiction	Library of Effects	Specific Effect
Functional Model	Library of Effects	Specific Effect

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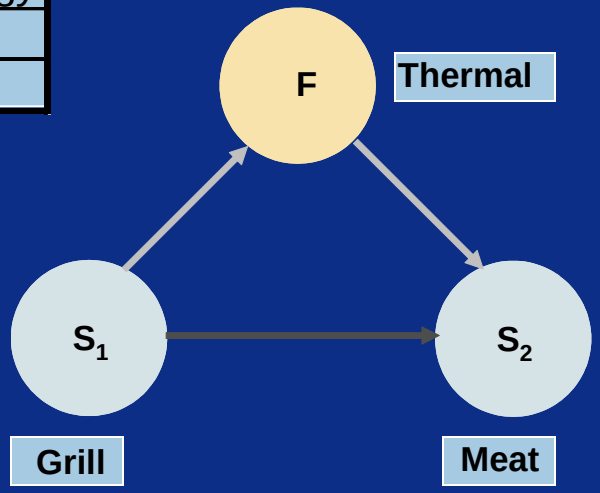
For Example:

Su-Field Model Example: If you want to cook meat using a grill, the two Substances are grill and meat, and the field is thermal energy.

Field (F)	Thermal Energy
Substance 1 (S1)	Grill
Substance 2 (S2)	Meat



Function Model versus Su-Field Model:

Function Model: a model of a Function being performed. Function Analysis deals with the entity Component that is a material object and can be either a Substance or a Field.

Su-Field Model: a model of the problem related to the Engineering System, but not of the Engineering System itself. Also, the substance and field are clearly differentiated.

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For Example:

Sub-Trend 4.)
Coordination of Action
0 D, 1 D, 2 D, 3 D

Trend of Increasing Coordination

Evolution Direction (0D - 3D)	Resource Available	
Desired Effect	Excess	Deficit
Strong Interaction	A →	← B
Weak Interaction	← C	D →

Coordination of Action	0D	1D	2D	3D
evolution direction → A	fishing pole	long line	net	trawling basket
evolution direction → A	computer	2 linked	internet	wireless connectivity
evolution direction ← B	pick	axe	hammer	meat tenderizer hammer
evolution direction ← C	point contact pizza box	corrugated bottom pizza box	flat bottom pizza box	
evolution direction → D			safety net	stuntman air bag

What Does the Guide Contain?

- Graphics based:
  - Examples
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For Example:

Trend of Transition to the Supersystem:

4.) Number of systems that integrate with the Engineering System increase
   a.) Mono-systems
   b.) Bi-systems
   c.) Poly-systems

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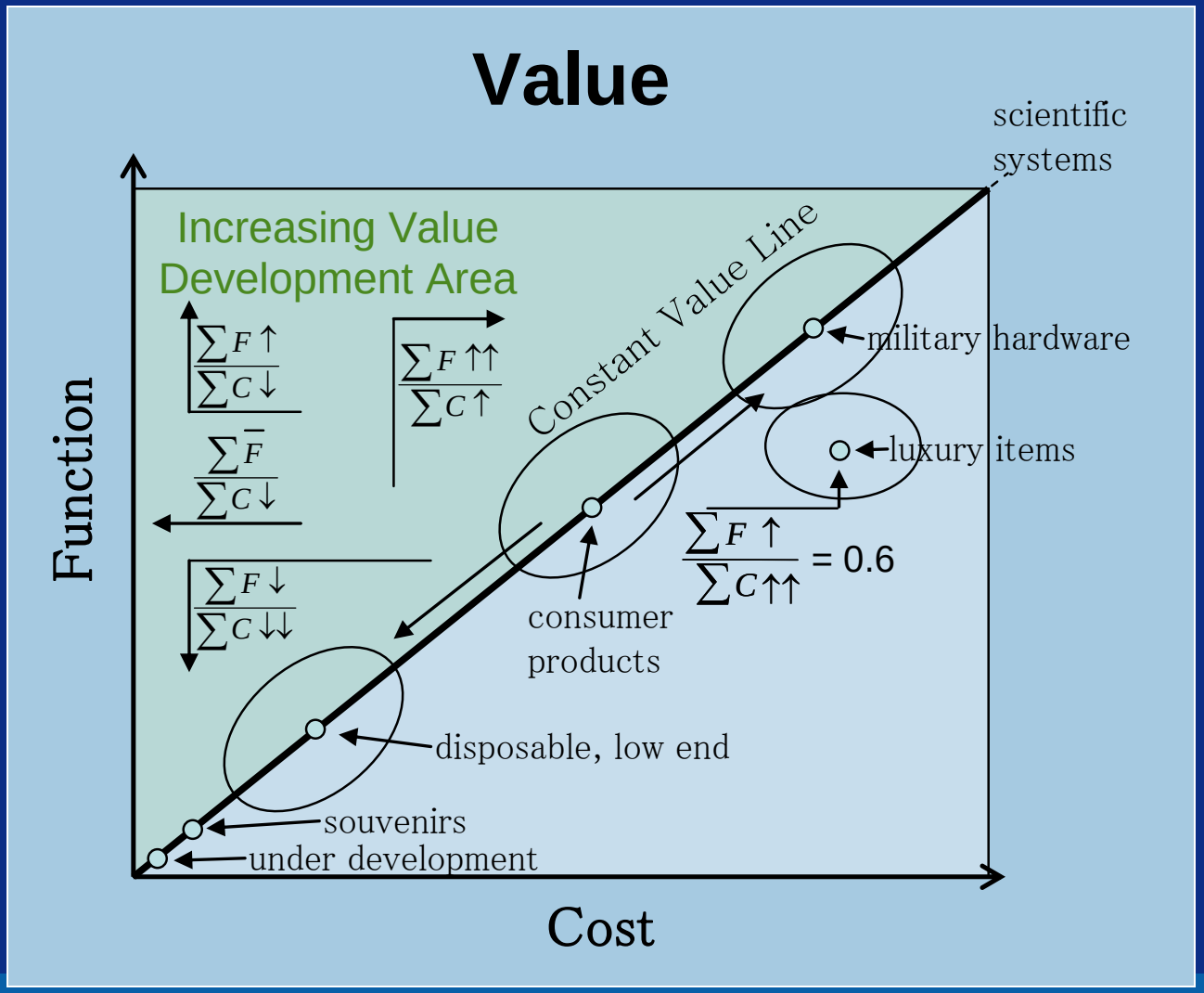


What Does the Guide Contain?

- Appendix:
  - Algorithm for Using Standard Inventive Solutions (AIST)
  - 39 Parameters w/ definitions
  - 40 Inventive Principles w/ examples

For Example:

39 Parameters*:

1.) Weight of moving object - The mass of or gravitational force exerted by a moving or mobile object.

2.) Weight of stationary object - The mass of or gravitational force exerted by a moving or mobile object.

3.) Length of moving object – Linear or angular dimension relating to a moving or mobile object.

4.) Length of stationary object - Linear or angular dimension relating to stationary object.

5.) Area of moving object - An dimension related to surfaces or surface area.

6.) …….

What Does the Guide Contain?

- Glossary – 80+ entries of TRIZ definitions and nomenclature
  For Example:

Section 38 – Glossary*:

- *Additional Functions* – A Useful Function that acts on a Component of the Supersystem that is not a Target.
- *Alternative Engineering System* – A Competing Engineering System that has a complementary pair of advantages and disadvantages to the Base Engineering System.
- *ARIZ* – A problem solving tool that transforms a complex engineering situation into a well defined model of the problem, which can be solved effectively using a wide spectrum of TRIZ tools. ARIZ is the Russian acronym for “Algorithm for Inventive Problem Solving.”
- *Etc.*
-

Other Benefits of the Guide

Shares concepts and relationships realized during training or simply not documented in the original training materials

- Level 1 – intro to TRIZ (launched into a new discipline)
- Level 2 – more tools available but utilization understanding can be overwhelming
- Level 3 – all tools available and a better understanding of methodology execution sequencing

Guide – documents nuances of the "art" of TRIZ execution

- **Functional Modeling** – "If the modeling has a large number (20-100s) of system Components to achieve the detail needed then the actual System you need to focus on is a subset of the system initially defined. For example: Blow Dryer Motor/Fan Assembly opposed to Blow Dryer"
- **Modeling Utilization** –
  - **1.) How to?** - How to type problems – use Specific Effects
  - *Starting place but any problem can be modeled in all three ways*
  - **2.) Interactions** – Interaction with Su-field – use Standard Inventive Solutions
  - **3.) Contradictions** – No clue how to solve – use Inventive Principles

Give practitioner quick reference guide to less frequently exercised concepts

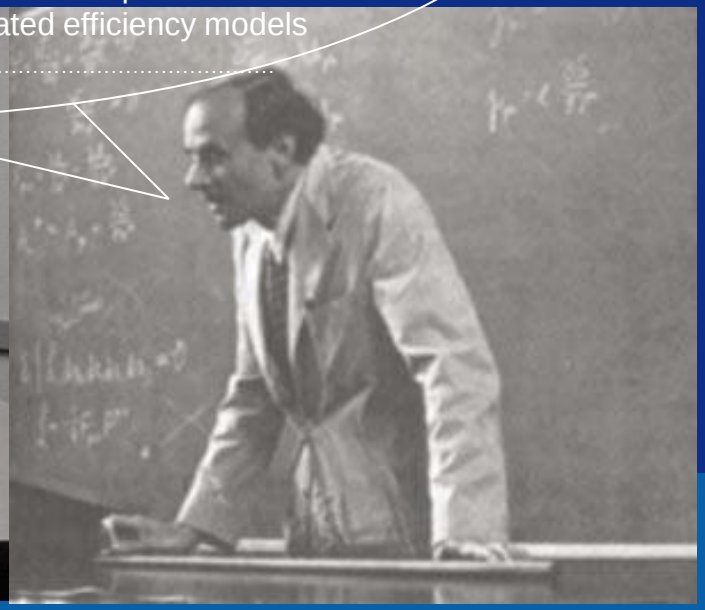
General review guide for refreshing knowledge base (Level 1, 2, and 3 practitioners) or discovering new concepts (Level 1 and 2 practitioners)

General Benefits of a Guide

Company, organization or industry specific jargon usage

- Helps tie the TRIZ methodology to nomenclature, terminology, and acronyms the student is familiar with

"the Cause and Effect Chain for this analysis is modeled around the utilization cycle of the clean room's facilities support equipment and is intended to improve the efficiency of our PM program of the same." Additionally, the facility systems can be functionally modeled for the purpose of understanding the potential improvement and trimming opportunities. The associated efficiency models can be shared in the VF to help with the standardization of .....



General Benefits of a Guide

Establish relationships between TRIZ and other organization methodologies or processes

- For example:
  - Utilize TRIZ within Step 3 in 7-Step Problem Solving which involves identifying the root cause of a particular issue

General Benefits of a Guide

Provide a specific application of TRIZ as a solution engine for a particular category of processes

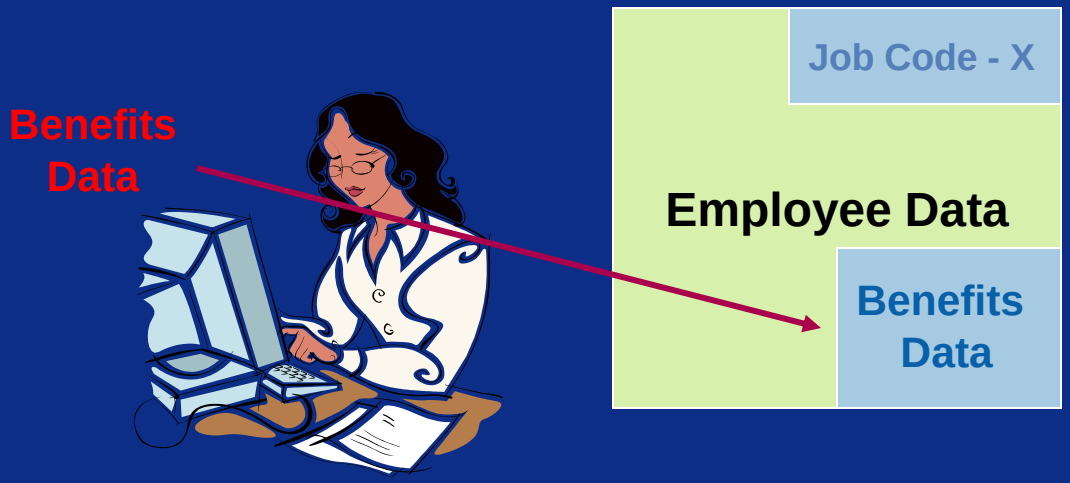
For Example:

- 9 Screens for Business/Application Solutions

9 Screens for Business Application/Solutions Intel/HR example***

1.) Employee changes job code

2.) Current benefits database does not allow job code change – new benefits calculations and data entry required



Software limitation was requiring significant rework for Intel's Human Relations department

s Application/Solutions

All HR labor associated with the necessity to reenter the employees benefit data upon Job Code change was eliminated by associating the employee's Job Codes with the manager's data set

	arate Databases	Integrated Databases
categories	Individual employee corporate data	Job Code - X All employees corporate data
Employees listed by HR data categories	Job Code - X Individual employee HR data	All employees HR data
Employees listed by	Individual employee benefits Benefits Data	All employee benefits data

A small business process change avoided a large software development project

How is the Guide Used?

Internally published

- Reference material for Level 3 practitioners
- Supplemental material for Level 2 and 3 training
- Supplemental material for non-TRIZ problem solving training
- General intranet down load from internal library

Summary of a Field Guide's Benefits

Concentrated Material

- 1500 to 80 pages

Establishes interrelationships of concepts

- Within TRIZ materials
- Between TRIZ methodologies and your organization

Reference guide

- TRIZ parishioners
- Other problem solving organizations

References

* Some text is copied from Gen3 Partners MATRIZ Level 1, 2, and 3 materials or is closely based on the same.

** Some graphics are form Gen 3 Partners MATRIZ Level 1, 2, and 3 materials or based on concepts from the same.

*** Example based on internal consulting by Juan Aranda (MATRIZ-3) to Intel Human Resources Department

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