Unified **S**tructured **I**nventive **T**hinking is a problem-solving methodology for creating unconventional perspectives of a problem, and discovering innovative solution concepts, when conventional methodology has waned.

Updates and Commentary

Dear Readers:

- In the last newsletter I asked for feedback on the CAF table. I got it! My good friend Matt Smith, of Curtiss-Wright Electro-Mechanical Corporation, took me to task for complicating USIT. My response to him is in the Feedback section. This response prompted rethinking of attributes. These thoughts are in the Mini-USIT Lecture section. I am grateful to Matt for his challenging feedback.

1. USIT – How to Invent: the USIT textbook.	$44.50

2. USIT – an Overview	FREE

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3. Mini USIT Lecture – 25

"USIT – an Alternative Method for Solving Engineering-Design Problems"

Continuation of **How to Invent** …

Recap of Mini USIT Lectures 21 - 24

I look at invention as achievable by at least two routes. Along the route of solving a problem, invention can happen accidentally – serendipity. An example is a method that has been used by cognitive psychologists is to provide a small group of rudimentary elements (simple line drawings) and a target product category. The goal is to use the given elements to produce design concepts in the given category. These are then judged and ranked for relative inventiveness – looking for serendipity.

In my opinion the key to finding effective solutions to problems and to invention is in-depth discovery of fundamental principles involved in any problem situation. A judicious search of plausible root causes guides this discovery. Pealing away cause/effect layers in search of root causes generates in-depth discovery. In this process of solving a problem an invention is simply one of the various solution concepts discovered but one that merits special recognition.

Invention can also be approached via a direct route. In fact by several different direct routes. The story telling route was mentioned in the last newsletter.

A direct-route strategy, based on USIT, is the topic of the current newsletters. It takes as an example situation that of inventing new concepts for an existing product. It adds the novel complexity of assuming product design history has been lost. Hence, the team addressing this problem has only the prototype object in hand, no history of its existence, and a charge to invent.

(Thoughts following Matt's feedback)
My fundamental assumption in this approach is that the only thing of "value" to a customer is functions of a product. Attributes, for the most part, are invisible to a customer and, consequently, of no concern. Of course appearance is visible. Appearance results from functions designed to create information (appearance).

The next assumption is that all functions are based on attributes. They are the root causes of all effects. A direct route to invention could start with attributes, pass then to functions they support, and on to recognized novelty – a definition of invention.

My third assumption, basic to all problem solving, is that creative thinking is sparked by recall of concepts hidden away in our subconscious storehouse of experience. Once surfaced to the conscious they are immediately tested, modified, and tested again for applicability.

Thus, with a prototype "in hand", the inventor begins to analyze it for the purpose of inventing a better product. A logical procedure is to gain a thorough understanding of the prototype from the original designer's (inferred) perspective. This is accomplished by assembling a list of evident attributes and their supported functions that can be inferred from the prototype. Along the way new functions for these same attributes may be discovered. Also functions for unused attributes may surface. And functions in need of unrecognized attributes may come to mind.

As seen in the ongoing discussion of a drinking vessel, a variety of attributes come to mind along with multiple functions. Keeping track of these and applying some semblance of useful organization for them led to the CAF table. Attributes were seen as a useful key for organization. In the interest of establishing a thorough search for attributes it was seen that a superior level of generic attributes would be useful. It would suggest areas in which to search attributes while also giving them organization. Thus arose "characteristics" in the CAF table.

This brings up the similarities of such words as qualifier, characteristic, attribute, and metric. They all distinguish objects. Metric is unique in that it alone introduces numbers for quantification. From my perspective they constitute a possible four-layer tier of "distinguishing features" of which CAF uses the last three.

****** To Be Continued in the next USIT Newsletter ******

5.   Problem-Solving Tricks and Related Miscellany

6.   Feedback   C-A-F Table feedback

MBS writes: "The CAF table seems to me to add another layer of complexity that isn't fully tied in or integrated to the basics. I'll buy into the OAF tables, because objects, attributes, and functions are the basic building blocks, so the table relating them makes sense. But where did the term "characteristics" come from? In your sample CAF table, you have things like "shape" listed. I thought shape was an attribute. The qualifier ("what shape") like "circular" or "concentric" would be metrics describing the attribute of shape. So maybe I'd be more comfortable if it was a AMF table - attribute, metric, function."

(This quotation is only one paragraph of MBS's provocative letter. Printed here with Matt's permission. Thanks, Matt.)

ENS response: I'll define the C-A-F table and then respond to specific issues raised.

The execution of USIT is "structured", as indicated in its acronym. Thus, when solving a problem we construct such things as OAF statements, closed-world diagrams, qualitative-change graphs, and CAF tables. These are simply worksheets that we lay before us and study to spark recall. As we use them we iterate their contents for more depth and scope. There is no point in wasting time to memorize their contents, so we post them in view while continuing the USIT process.
The general layout of USIT, with its focus on a single unwanted effect, is ideal for problems having prototype solutions. After applying it a few times on routine "fix-it"-type problems, students show some inertia toward using it to invent. The CAF table helps. It is a worksheet loaded with pertinent cues for invention.

The key to the utility of the CAF table worksheet is that it was created using in-depth analysis of a prototype object. It was done to infer as many attributes as possible and from them to infer plausible functions – the order, attributes then functions, is selected intentionally to inspire fresh thinking. Note that plausible functions may turn out to be original ideas.

Characteristics, as used in the CAF table, are simply a generic level of attributes; they provide some ordering of the inferred attributes. Recall that the words function, effect, unwanted effect, cause, and root cause have equivalent roles in USIT (see USIT NL_19). On the other hand, the words attribute, causal attribute, and (attributes with …) metrics are all attributes but of differing distinction. (I can't bring myself to say, "Attributes having different attributes". ☺)

Yes, shape is an attribute. And attributes of shape are square, rectangular, circular, ellipsoidal, etc. And attributes of circles are diameters, coaxial, concentric, coplanar, etc. A metric of square is a side equals 1.1 mm. A metric of circle is a radius equals 2 in.

The USIT definition of attribute is that it characterizes or distinguishes objects. Similar objects, but not equal ones, may require multiple attributes and/or specialized attributes to distinguish them. Dissimilar objects may be distinguished with fewer or less specific attributes.

I simply introduced characteristics as a superior level of attributes for the convenience of tabulating observations of the prototype vessel. However, I don't wish to introduce metrics for any constructive purpose. This is still pre-engineering where metrics do not belong.

Regarding simplicity of USIT, note that the CAF table eliminated objects.

7.	Q&A	Questions you would like to have discussed are welcome.

8. Other Interests

- Regarding inquiries about ordering the book, "Unified Structured Inventive Thinking – How to Invent", details may be found at the Ntelleck website: www.u-sit.net. The cost of the book is US$44.50 plus shipping and handling. See the website for S/H charges. Send a check made out to **Ntelleck, LLC** for the proper amount, drawn on a US bank, to

Ntelleck, LLC, P.O. Box 193, Grosse Ile, MI 48138 USA

Please send your feedback and suggestions to Ntelleck@u-sit.net

To be creative, U-SIT and think.